AD-A254 512

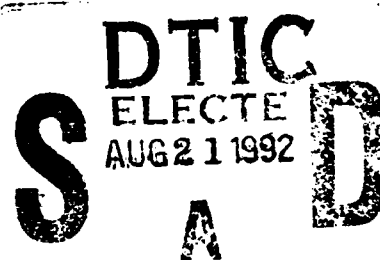# Multipurpose Arcade Combat Simulator Development to Improve Soldier Shooting Skills With the M16A3 Rifle

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13. ABSTRACT (Maximum 200 words)

This report provides details of the effort (February to December 1991) to produce a Multipurpose Arcade Combat Simulator (MACS) program for the M16 rifle with telescope (M16A3). Because the Army delayed selection of a telescope, all aspects of the program could not be completed; programs were developed using the telescope reticle with the highest probability of selection. The program may be fired with telescope or iron sights. It reviews basic marksmanship, the long-range engagement of stationary and moving targets, the effects of wind, and the combined effects of range, wind, and target movement.

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MULTIPURPOSE ARCADE COMBAT SIMULATOR DEVELOPMENT TO IMPROVE SOLDIER SHOOTING SKILLS WITH THE M16A3 RIFLE

CONTENTS

CONTENTS (Continued)

MULTIPURPOSE ARCADE COMBAT SIMULATOR DEVELOPMENT TO IMPROVE SOLDIER SHOOTING SKILLS WITH THE M16A3 RIFLE

INTRODUCTION

The Army plans to put an optical sight on the M16 rifle, modifying the M16A2 so an optical and/or iron sight may be affixed to the upper receiver. The rifle will be designated the M16A3.

This subtask was sponsored by the U.S. Army Infantry School, funded by the Army Materiel Command with funds designated for training development, and was monitored by the U.S. Army Resarch Institute (ARI).

When the statement of work for this contract subtask was developed, it was envisioned that by December 1991 the first units would be equipped with the new M16A3 rifles. The intent of this contract effort was to develop appropriate MACS software and training guidance to enhance soldier shooting skills with a telescope and deliver 15 MACS systems to support the testing and initial fielding of the telescoped rifles. The MACS rifles and telescopes were to have been provided by the Army.

With the termination of Litton's association with ARI concerning this effort on 31 December 1991, the telescope has not yet been selected by the Army. Three telescopes were tested at Fort Bragg during October and November 1991; test data are still being analyzed and it is too early to predict a winner. Additionally, none of the three reticles is designed to facilitate hold off for wind, lead for moving targets, or range estimation. The graphics developed for the MACS training program highlight the critical need for these features, and the Army has agreed to consider our recommendations in the final reticle design.

This situation makes it impossible to complete full development of any MACS program by 31 December 1991 because the reticle design and accompanying hold off/lead rule procedures are critical elements of the MACS training program. Also, the MACS rifle and telescope design cannot be finalized until a telescope has been selected. Accordingly, the purpose of this Research Note is to provide the information necessary to finalize MACS software programs, MACS hardware, and marksmanship training materials after final telescope decisions have been made by the Army.

MACS COMPUTER

For several years the Army has used the Commodore 64 Microcomputer for MACS. There are three problems currently associated with the Commodore: Commodore may stop production of the 64, a government regulation identifies the

Commodore 64 as automatic data processing (ADP) equipment and this makes it difficult to obtain it as a training device, and the 64 is old technology with much less capability than other available hardware.

Our previous experience programming MACS for the Army's Zenith 248 microcomputer revealed that additional memory capability is not necessarily an advantage, because this computer is not designed to handle the complex graphics and sound needed for marksmanship training. The hardware developed for games appears to be the most cost-effective for MACS applications.

Investigation of current gaming hardware found that Nintendo provided the widest range of capabilities at low cost. We purchased a Nintendo system and worked with the Fort Benning Training Support Center (TSC) to determine if the Nintendo hardware could be integrated into the current MACS system.

The primary software developer for Nintendo, Sculptured Software, developed a MACS demonstration program for Super Nintendo and presented it to the Infantry School. The Infantry School decided to continue distribution of Commodore systems until the current supply is exhausted and then convert MACS to Super Nintendo.

The Super Nintendo system provides much better graphics, stereo sound capability, much more memory, and is easier to program. Given that the Super Nintendo cartridge has memory capabilities equal to several Commodore cartridges, the Super Nintendo MACS system will be less expensive than the Commodore MACS system.

Given the limitations of time and money associated with this contract effort, we made an early decision to stay with Commodore and purchased 15 systems. All in-house programming associated with this effort will be for the Commodore system; however, a detailed programmer's packet was provided to Sculptured Software so the telescope program can be included on initial Super Nintendo MACS systems.

MACS MONITOR

A 13-inch Commodore monitor has been used with previous MACS rifle systems. A 26-inch monitor was used with our prototype MK 19 grenade machine gun program because the additional screen area was needed to represent long ranges and to allow for elevation of the gun. We considered a larger monitor for the telescope MACS system because moving targets could be better represented, long range targets would appear more realistic, it would enhance some scenarios and the entire screen could not be observed through the telescope. It was decided to stay with the small monitor, primarily so this MACS program would be interchangeable and compatible with other MACS programs which are currently in the field.

MACS RIFLE FOR TELESCOPE

The rifle used for the telescope MACS program should accommodate a telescope or iron sight. It seems appropriate for the MACS rifle to have a Weaver-type rail on top of the upper receiver which will accept a standard A3 telescope or the A3 iron sight. An actual upper receiver could be incorporated into demilitarized MACS rifles, but this is very expensive, cannot be integrated into many of the MACS rifles currently in use, and may require additional modification to prevent reconstruction of a firing weapon. The most reasonable solution appears to be the modification of a demilitarized rifle or a well-constructed model rifle, by sawing off the carrying handle and replacing it with a Weaver-type rail. This will accommodate the scope or iron sight. This procedure results in a suitable MACS rifle and retains the low cost which is an important feature of MACS. We modified one rifle in this manner and used it for our development work.

We worked with TSC on the establishment of new MACS rifle specifications and included requirements which will ensure sufficient rigidity of the upper receiver area so future MACS rifles can be modified for telescope use.

MACS TELESCOPE

None of the three candidate telescopes would work on MACS. They could not be focused at short range and parallax was so bad that they could not be used for training. During the previous testing of telescopes by the Army, the ELCAN scope had been favored. The ELCAN scope purchased by the Army for the most recent testing was the only one with a reticle which was identical to the Army's preferred reticle specifications. Therefore, we purchased an ELCAN scope which had been focused for 110 inches for our initial MACS development work.

This scope was adequate for MACS use, but a serious disadvantage was that the entire 13-inch screen could be viewed through the scope. An important task for emphasis during training is the visual identification of a target and then rapidly acquiring that target through the telescope. If all targets could be observed without moving the eye from the scope, this important shooting skill would suffer. Another real disadvantage of the actual scope is that it would add approximately $500 to the cost of the MACS system and the scope would not be usable on an actual rifle due to the internal modification required for the short range focus.

We experimented with the construction of a telescope which would be inexpensive and more training effective. While trying various combinations of lenses, we found a .22 rifle scope which could easily be modified for MACS purposes. To provide some visual credibility to the thin .22 scope, TSC developed a telescope housing and mount which will be longer, but will look similar to the actual telescope. The .22 scope is inserted into the telescope housing, the crosshair reticle is removed

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and replaced with a reticle like the one used in the actual scope and the rear portion of the scope is adjusted to focus on the reticle and the screen at 110 inches. This eliminates all significant parallax and allows viewing of about one-third of the screen area. Using the Simmons rifle scope model number 1002 at a cost of $9.92, with the telescope housing and mount developed by TSC, should result in a very effective MACS telescope for a total cost of $20 to $25.

MACS LIGHTPEN

This contract required the delivery of 15 lightpens. Given that the horizontal jitter experienced with conventional lightpens would detract from effectively training long-range precision shooting, an effort was made to develop an improved lightpen -- one which would reduce horizontal variability from two pixels to one pixel. Futurity Technologies submitted a bid for the improved lightpen which was comparable in cost to what the Army has been paying for standard lightpens. The 15 improved lightpens must undergo field evaluation to determine their worth; however, they have been demonstrated to have no more than one pixel horizontal variability. In any case, during general use they appear to be as good as standard lightpens and they represent a significant step in the development of smaller, more reliable and more accurate lightpens for the MACS system. As part of their development effort, Futurity Technologies worked with one of our programmers to redesign the setup routine used for lightpen calibration. The old routine was a Basic program which did not take readings as fast as they are taken during the firing portions of the program. The new setup routine, in Assembler, allows the lightpen to be calibrated with the same frequency of readings as the firing exercises. This allows the new lightpen to be more stable but this new setup program enhances the performance of all MACS lightpens.

15 MACS SYSTEMS

This contract specifies the delivery of 15 complete MACS systems. However, rifles and telescopes were to have been furnished by the government and they have not been provided.

Initially, it was envisioned that 15 upper receivers and 15 telescopes would be provided to support this project. However, these were not available and now there appears to be a general consensus that it will be more cost effective to utilize modified MACS rifles and training telescopes described above. Also, since the telescope decision has been delayed, it seems inappropriate to provide rifles or telescopes until it is known what telescope design the Army will purchase. The possibility also exists that the Army may decide not to buy telescopes.

Given this situation, all components required to construct 15 MACS systems (computer, monitor, lightpen, trigger switch, wiring harness) are available at TSC for

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assembly as soon as the telescope decision is made and rifles and telescopes are available for MACS use.   The specifications required for assembly of a low-cost rifle and telescope are also available at TSC.

It should be noted that if the Army decides not to buy telescopes, the 15 MACS systems and software may be used with iron sights as an advanced marksmanship program.

MACS TELESCOPE SOFTWARE

The programming of the telescope MACS Commodore cartridge was very difficult. Using a programmer who was new to MACS, but a highly recommended and competent programmer, we were unable to produce a high-quality program after several weeks of work. The current Commodore MACS program was developed over many years, first in Basic and then Assembler was used to modify, speed up, and enlarge the program. Several quick-fixes have been incorporated and this has resulted in a program which is very difficult to maintain and programming on the Commodore is quite archaic, given what most current programmers are familiar with. If the Commodore system should be retained, all programs should be converted to a new language, probably "C." We considered this for the current program but decided it was too high risk, given the limited time and resources. Also, since it appears that the Commodore is being phased out and this is probably the last MACS program to be developed on Commodore, it appeared reasonable to make another "fix" to the existing Commodore format. Two previous Commodore programmers, who are available only on a part-time basis, were used to develop the Commodore programs.

Four software products are delivered as a result of this effort:

Cartridge/Basic Rifle Marksmanship with Reticle Option -- This is the current Basic Rifle Marksmanship (BRM) program, with two exceptions: the set-up routine has been replaced with a routine which was developed to enhance adjustment and performance of the lightpen and an option is provided to fire the program with iron sights or reticle. If a telescope is used on this program, all replays will show the reticle instead of iron sights. This cartridge is fully compatible with existing MACS systems which are in use and will allow soldiers to practice with the telescope while seeing their aiming point displayed as the appropriate reticle. It must be emphasized that the reticle used in this program is the current ELCAN reticle and must be replaced if that reticle is not selected by the Army or is modified prior to acquisition. Additionally, this program retains the words associated with the iron sight, e.g., leading edge, and these words must be modified to match the selected reticle. It should also be pointed out that the ballistics used in this program are applicable to the M16A1 with a 250-meter battlesight zero and M193 ammunition. While this program will be very useful in allowing soldiers to gain familiarity with the telescopes, these differences should be pointed out by trainers.

Cartridge/Moving Target Training with Reticle Option -- This program has undergone the same modifications as the BRM program discussed above.

Cartridge/Infantry Rifle Marksmanship (Telescope) Commodore Program -- This is a unique telescope program developed for the Commodore computer. Given the limitations of Commodore memory, it addresses only long-range targets, wind, long-range moving targets, and firing situations which require simultaneous adjustment for wind and movement. The detailed training material needed for development of the Trainer's Guide to support this program is contained in the following discussion of the programmer's packet.

Programmer's Packet/Infantry Rifle Marksmanship (Telescope) Nintendo Program -- The 130-page programmer's packet at Appendix A is the full MACS program developed to improve soldier's shooting skills with the scope rifle. This may be programmed by Sculptured Software but not associated with this contract effort. The remainder of this section is keyed to the Infantry Rifle Marksmanship (Telescope) Nintendo Program.

As with all other aspects of this effort, the software cannot be finalized until a telescope and reticle have been selected. The three reticles currently under consideration by the Army are shown at Appendix A, page 3. As an integral part of our training development effort associated with this program, we designed a reticle which we believe will greatly enhance the rifleman's performance. This reticle has been presented to the Infantry School for consideration but it is not used in the MACS program because the Army decision makers have indicated a preference for a circle and inverted V. Accordingly, the ELCAN reticle is used throughout the MACS program, along with the option of the iron sight. However, to assist in reticle selection and to promote discussion which may result in selection of the best reticle for the soldier, the ARI reticle is used throughout this paper. Again, it is important to note that when a final reticle has been selected it must be represented in this program and several word changes must occur as lead rules, hold off, etc. are discussed. In recognition of this requirement, the program has been designed so reticle replacement will be a relatively easy fix.

This program is designed to be fired with telescope or iron sights, so it is fully appropriate as a training tool for Infantry Rifle Marksmanship or other advanced marksmanship training with the M16A2 rifle, the M16A3 with iron sights, or the M16A3 with telescope. A replica M16A1 MACS rifle may be used, but the soldier should understand that the MACS program represents M16A2 ballistics.

Training developers and programmers should know that the Moving Target cartridge was developed subsequent to the Basic Rifle Marksmanship cartridge and as questions arise concerning the commonality of procedures between the current program and either of these two programs, priority should be given to the Moving Target Program.

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The zero routine has been modified to force the soldier toward an excellent zero. To prevent this from being a stopper, after six attempts, the soldier may elect to advance with the last zero fired.

Level 1 is a review of the BRM cartridge. Given the training level of most soldiers, this condensed version of BRM provides a needed refresher of shooting fundamentals. Soldiers who have recently completed firing the standard BRM cartridge may skip this level. Note that the ballistic information on page 11 of Appendix A is applicable to the M16A2 rifle with a 300-meter zero. If the center of the selected telescope (line of sight) is more than 2.6 inches above rifle boreline, or if a sight setting other than 300 meters is used for battlesight, these data must be changed accordingly.

Level 2 is a condensed version of the current Moving Target cartridge. Again, it will be beneficial for soldiers unless they have recently fired the Moving Target cartridge, in which case they may want to skip this level. The reticle, when selected, is used for all demonstration and replay. Note that this paper provides the words which are appropriate for the iron sight, the ELCAN reticle, or the ARI reticle. The words will need to be adjusted to match the selected reticle and appropriate holdoff and lead rules.

Level 3 introduces the soldier to long-range shooting. The Army is currently exploring ways to improve ability to engage targets at extended ranges (e.g., to 550 meters). In this MACS program targets are displayed at ranges from 300 to 800 meters in 100-meter increments. Additionally, since the maximum effective range of the rifle is listed as 550 meters, a 550-meter target is included. While the Army has no established standards for extended range targets, the MACS criteria were established based on previous firing data, current observations, and our best judgement. The standards and ranges may require adjustment after soldiers have an opportunity to train and be evaluated using the new telescope.

Shooting at long range is a much more difficult task than shooting at short range, even though the fundamentals are the same. If a 200-meter target is missed, it is safe to assume that shooting fundamentals were not properly applied. However, the soldier may apply shooting fundamentals perfectly and miss a 500-meter target. This may be due to inherent inaccuracies of the rifle or ammunition, effects of wind, an improper range setting on the sight, an error in the estimated range to the target, a less-than-perfect zero, or several other factors. This level eliminates all of those variables and assumes a perfect zero with the sight set at the precise range to the target under no wind conditions. If fundamentals are applied perfectly, the bullet will be displaced from target center only by the inherent error in the lightpen and the MACS system. Any MACS system which is properly adjusted and in good working order will be more accurate than the typical rifle system. Accordingly, the purpose of the initial portion of this level is to provide practice on the very careful application of fundamentals required to hit distant targets under ideal conditions.

When the standard is not met for a particular range, the soldier is told to work on the fundamental for which he received the lowest rating during the engagement of the five targets. All fundamentals which are rated average or below will be shown.

Sometimes it may be appropriate for weak shooters who cannot meet a particular standard to advance through the program, hence at the end of each range, the soldier may elect the option of advancing to the next segment of the program. Trainers should provide additional guidance based upon their evaluation of the soldier's ability and shooting problems.

Soldiers should understand that the objective of suppressive fire is to come as close to targets as possible and that the failure to hit targets at 700 and 800 meters is normal, given the many variables and the very small visual angle represented by a single target at these ranges.

At screen 3-47 of Appendix A the point is made that sights should always remain at battlesight zero, 300 meters, unless a specific target is being engaged. The following firing exercises are intended to familiarize the soldier with the amount of hold off required to hit distant targets while sights remain on the battlesight setting.

Note that this MACS program has been developed under the assumption that sight changes for various ranges will always be made electronically and that the sights on the MACS rifle will not be physically moved. If it is considered desirable to have the soldiers make physical sight changes on the MACS rifle, that is an option which could be incorporated after a sight system has been selected and evaluated for this application on MACS. The training telescope discussed earlier does not incorporate the capability of moving sights. We believe that some problems could be experienced among various MACS systems due to the wide variety of MACS rifles which are in use. Additionally, a MACS sight which was adjustable would have to be as rugged and accurate as the actual sight, increasing cost and complexity of the system. Part of our consideration for this approach is that the adjustment of the sight is a relatively simple task which the soldier can practice on his actual rifle in a non-firing environment.

Since the maximum effective range of the M16A3 is 550 meters and no telescope candidate or the iron sights have a setting for 550 meters, the last targets on this level provide practice in shooting a target at 550 meters -- with both a 500 meter setting and a 600 meter setting.

Level 4 introduces the soldier to moving targets at long range. The current moving target range on Fort Benning has moving targets at a maximum range of 185 meters. These ranges are represented in Level 2 of this program. However, these targets on the defense test range were based on a threat analysis which gave high priority to close-in targets and failed to identify any significant requirements beyond 300 meters. The current effort with the telescope promotes attempts to engage stationary targets out to ranges of 550-600 meters and possible suppressive fire at

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ranges to 800 meters. If this is deemed to be a suitable employment for the M16A3 rifle, it appears very unlikely that we would start engaging stationary personnel targets at ranges of 600 to 800 meters but not engage any moving personnel targets until they reach a range of 185 meters. Accordingly, this level establishes lead rules and provides practice in the engagement of moving targets to ranges of 300 meters. Given that the hit probability against stationary targets at ranges out to 500 and 600 meters will be relatively low under conditions of combat, one could make the case, given the many variables involved, that the hit rate against moving targets at these ranges may not represent a significant additional degradation. However, 300 meters was selected as the maximum range for this program because the probability of the Army committing resources to conduct effective training against moving targets beyonr· this range is considered highly unlikely.

The single lead rule was developed by ARI to simplify the engagement of moving targets; however, this rule must be expanded to hit fast-moving targets at extended ranges. Given the many variables, there is no simple set of rules which will hit target center at all possible speeds and all possible ranges. The single lead rule is established by placing the trailing edge of the front sight post at target center; therefore, this amount of lead is equal to one-half the perceived width of the front sight post. Referring to this as one lead, two leads are equal to the perceived width of the front sight post and three leads are equal to one and one-half times the perceived width of the front sight post. The ARI sight reticle has hash marks which equate to these leads but the ELCAN and other sights under evaluation do not have lead marks at this time. When a final reticle is selected, appropriate adjustments must be made to this program and to the aiming rule for moving targets. The following rules have been established as a memory aid to assist soldiers in the engagement of long-range moving targets:

- Use the single lead rule (one lead) for all targets within 125 meters.

- For targets beyond 125 meters, use the following:

    -- walking, one lead

    -- jogging, two leads

    -- running, three leads

This memory aid should be easy to remember and it will provide good hits on the majority of moving targets encountered on the battlefield. The scale of targets and ballistics used in this program are very accurate, so when a soldier can fire a good score on this moving target section he will have greatly improved his ability to hit moving targets on the battlefield.

Level 5 addresses wind, a very important factor in long-range shooting. The current Army policy is to establish a no-wind zero on the rifle and use hold off to compensate for the effects of wind. A memory aid has been developed to assist soldiers in determine how much to hold off. The rule: 1, 5, 1, 2, 3, 5 is based upon the effects of a 10 mile per hour, full value wind. The numbers mean that the effects of a 10 mile-per-hour wind are 1 inch at 100 meters, 5 inches at 200 meters, 1 foot at 300 meters, 2 feet at 400 meters, 3 feet at 500 meters, and 5 feet at 600 meters. A 10 mile-per-hour wind is a relatively common wind, and knowing that the effects of wind are uniform in relation to speed, e.g., a 5 mile-per-hour wind moves the bullet half as far at each range and a 20 mile-per-hour wind moves the bullet twice as far at each range, the soldier can get a relatively good idea how much to hold off under various wind conditions if he just remembers 1, 5, 1, 2, 3, 5.

The Marksmanship Field Manual, FM 23-9, provides a discussion on wind measurement using the flag method, the pointing method, and the observation method. This MACS program incorporates another cue which may be present on the battlefield, a rising column of smoke.

This program accurately reflects the amount of bullet displacement caused by various winds. Of course, the soldier will never have an accurate measure of wind on the battlefield and the effects of wind will seldom be uniform between the firing position and the target area. While this MACS program is essential for learning how to compensate for the effects of wind, it is no substitute for rifle practice under various wind conditions with appropriate feedback.

The 5-shot replay at the end of each range allows the soldier to reflect on his performance for each shot while he sees the wind direction and speed for that shot. Note that the memory aid is used throughout this level to promote understanding and encourage its use.

Level 6 puts it all together. With rifle sights remaining on battlesight zero, stationary and moving targets are engaged at ranges from 75 to 400 meters under various wind conditions.

The individual target replay shows the aiming point necessary to hit target center when only one factor is considered. The aiming points needed to allow for range, wind, and target movement are shown individually as well as the correct aiming point which properly integrates these three factors. The soldier's aiming point is also shown for each target.

Hold off for range is not affected by wind or target movement, so it remains a constant. It will be noted that when wind and target movement are in opposite directions, the hold off required will be additive and when they are in the same direction, one will compensate the other to some degree. In an actual environment, the soldier should use what holdoff is necessary to compensate for wind -- it's always

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in the same direction regardless of target movement and then lead the target the appropriate amount from the wind holdoff point. While this can appear to be a very complicated exercise, these are factors which must be mastered to be an effective battlefield marksman.

CONCLUSION

Given that an Army decision on telescope selection has been delayed beyond the time allotted for this contract effort, this Research Note provides information and guidance which will assist in finalizing MACS software, MACS hardware, and marksmanship training materials when final telescope decisions are made.

APPENDIX A

PROGRAMMER'S PACKET

SCREENS
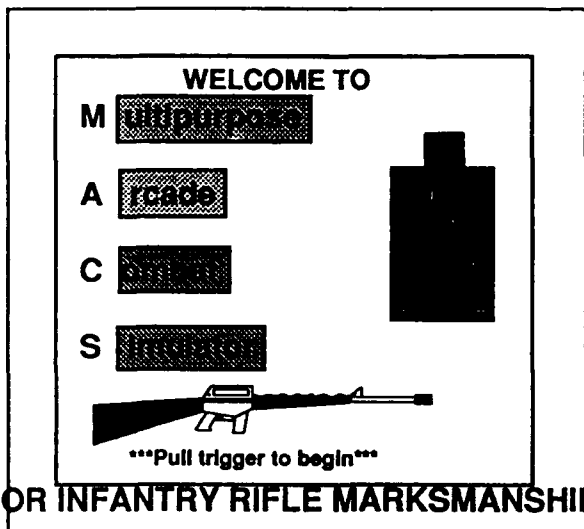
This paper provides general guidance to programmers for the Infantry Rifle Marksmanship (Telescope) Program. The program is designed to support training with the M16A3 rifle (M16A2 with telescope).

0-1

WELCOME TO

M ultipurpose
A rcade
C ombat
S imulation

Pull trigger to begin

FOR INFANTRY RIFLE MARKSMANSHIP

0-2

This MACS Program may be fired with telescope or iron sights and provides instruction and practice on M16 combat skills.

(Pull Trigger to Continue)

0-3

INFANTRY RIFLE MARKSMANSHIP PROGRAM

· - Zeroing

Levels
1 - Fundamentals - Stationary Targets
2 - Fundamentals - Moving Target
3 - Long Range Stationary
4 - Long Range Movers
5 - Wind Effects
6 - Battlefield Practice

(Pull Trigger to Continue)

0-4

> This program may be
> fired with telescope
> or iron sights.
>
> Select the one you want.
>
> TELESCOPE   IRON SIGHTS
>
> POINT RIFLE AND PULL
> TRIGGER TO SELECT SIGHT.

Selection will blink when rifle is
pointed at it.

0-4a

> You have selected to
> fire the program
> using (iron sights) or
> (a telescope).
> Is this correct?
>
> YES   NO
>
> POINT RIFLE AT ANSWER
> AND PULL TRIGGER.
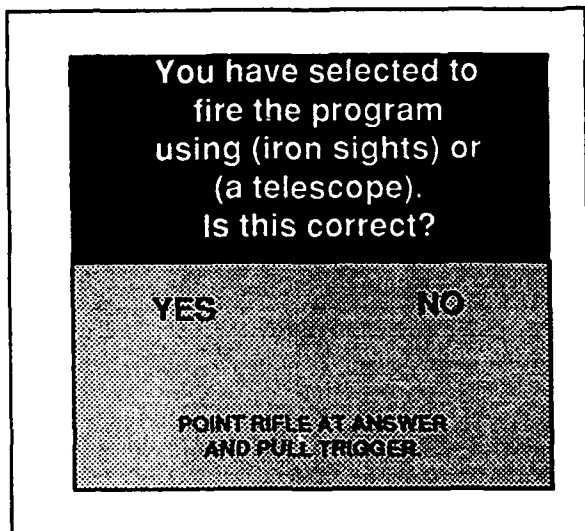
NOTE: Visual of iron or reticle. If
"NO" is selected, return to 0-4.

0-5

NOTE: The M16A2/M16A3 iron sight and the M16A3
reticle will be used on this program. However, we will not
know which reticle the Army has selected until this
program has been completed. The three reticles in
scopes currently being tested are shown at Page 3, as
they will appear on a zeroing target at 25 meters. At the
center of Page 4 is an ARI reticle which has been ap-
proved by Dr. Smith. Note that this is a modification of
the reticle used in the 15 July edition of this paper. The
earlier reticle remains in some parts of this paper, but will
not appear on the MACS screen. Given that the reticle
decision remains somewhat open and that we must be
able to substitute the final reticle as a last minute fix, use
the ELCAN reticle and the A2/A3 iron sight in the primary
program. This will allow the aiming point to always be the
same for the center tip of the front sight post or the tip of
the inverted "V." The aiming point for the ARI reticle will
be different because it is based on a 250-meter battle-
sight zero and no sight adjustment is required to engage
targets at range. The initial MACS program will use the
rule shown at Page 4. At Page 5 the iron sight and both
reticles are shown the actual size that they should appear
on the MACS screen.

52.4 cm

33.6 cm

-- 49 cm --
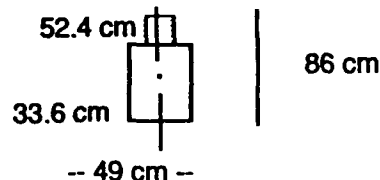
86 cm

Graphic of
300-m target
showing
center mass
spot. The
same 300-
meter zero
will be used
for iron and
scope. The
actual target
size is
49x86 cm,
with center-
of-mass
33.6 cm
from the
bottom.

MACS INFANTRY RIFLE MARKSMANSHIP (TELESCOPES)   30 August 1991   Page 2
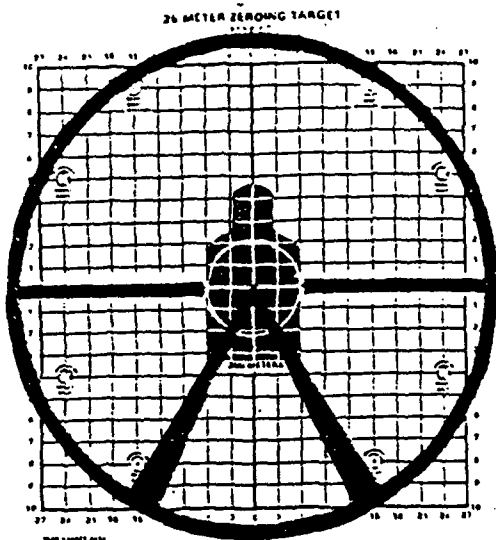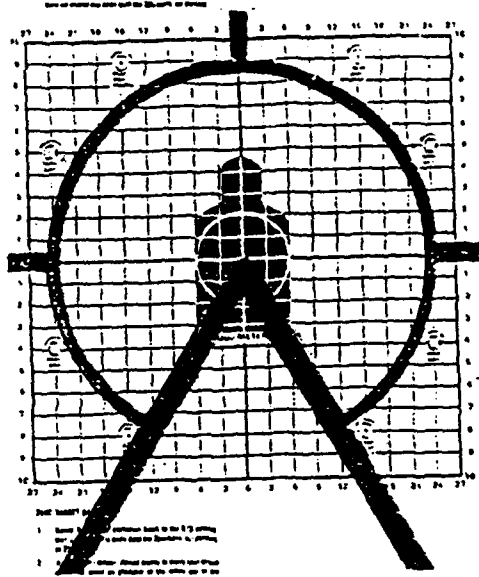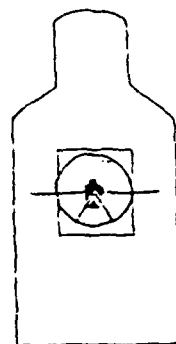
ELCAN

SUSAT
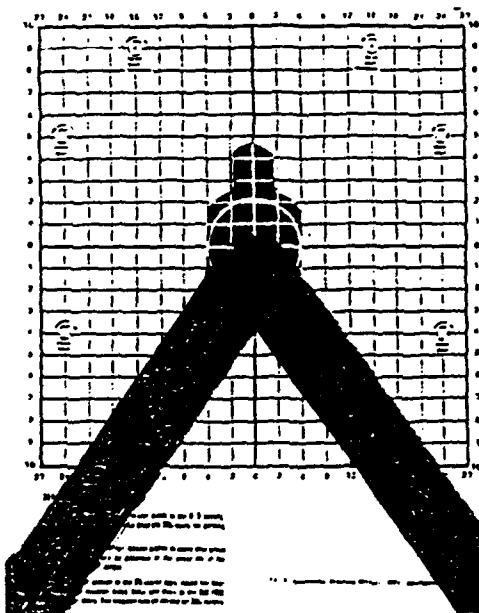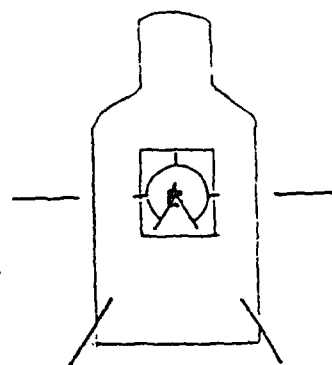
S-TRON
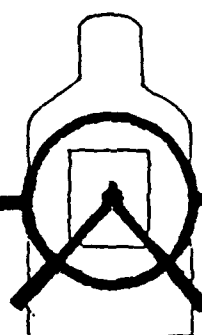
MACS INFANTRY RIFLE MARKSMANSHIP (TELESCOPES)
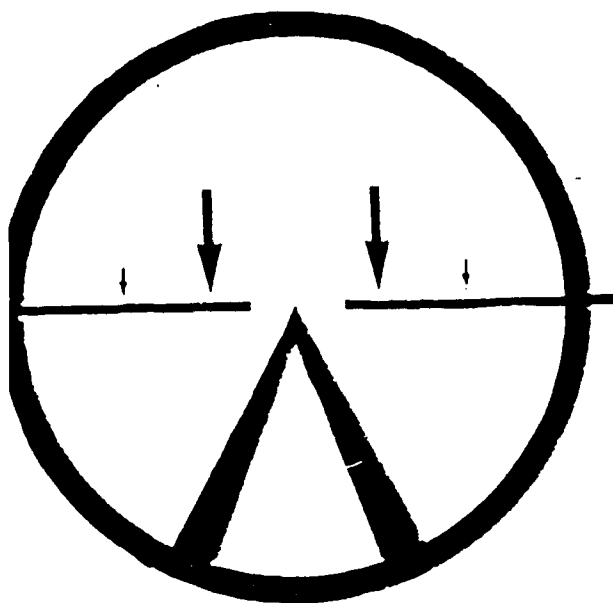
NOTE: Since hold-off and lead rules do not exist for the ELCAN or any of the reticles under consideration, and since our initial efforts did not result in rules appropriate for soldiers, invisible lead points have been established on the ELCAN which equate to the lead marks on the ARI reticle. These invisible points will not be used on the MACS screen -- just used as a guide in placing the sight. The two reticles and sight post on this page are on the same scale. For the ELCAN, note that the bottom of the inverted "V" represents one lead and is about the width of the sight post (large arrows). The second lead (small arrows) is about half the distance to the outer circle and the outer circle will serve as the third lead point.

NOTE: This initial MACS program may be used as a doctrine development vehicle, and will hopefully result in good hold-off/lead rules or reticle modification.

NOTE:
ARI reticle,
M16A2/3
front sight
post, and
ELCAN reticle,
scaled to the
size they
should appear
on the MACS
screen.

0-6

ASSUME A
SUPPORTED
POSITION

Pull trigger for targets
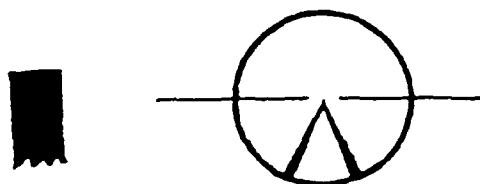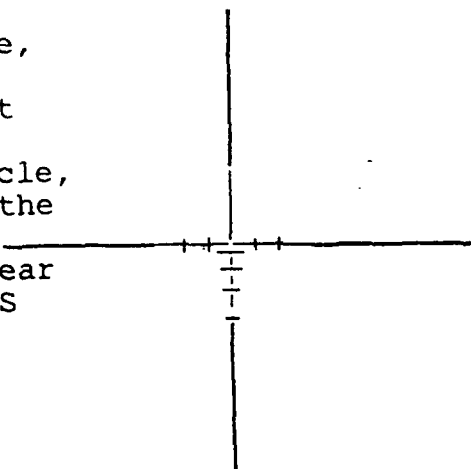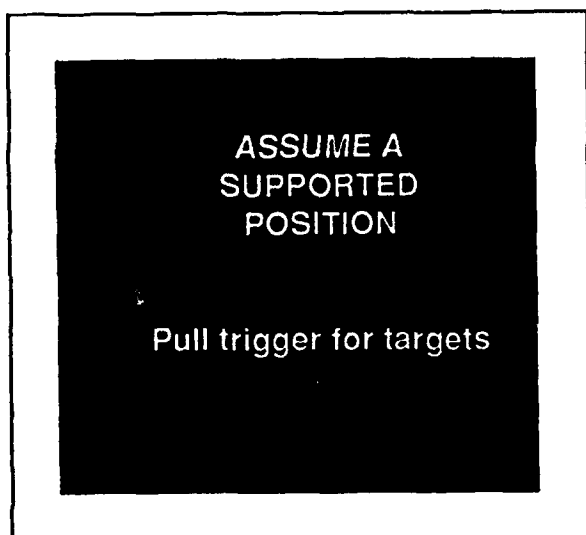
"Pull trigger for targets" in
RED for all screens when the
next screen is a firing re-
quirement.

0-7

NOTE: Previous zero targets
are scaled for 250 meters. This
one is scaled for 300 meters.

Graphic scene of range - 3 tar-
gets presented - one at a time.

0-8

```
STEADY POS          GOOD
AIMING              ...
BREATH CON.         OK
TRIGGER SQ.         GOOD




          (Pull trigger to continue)
```
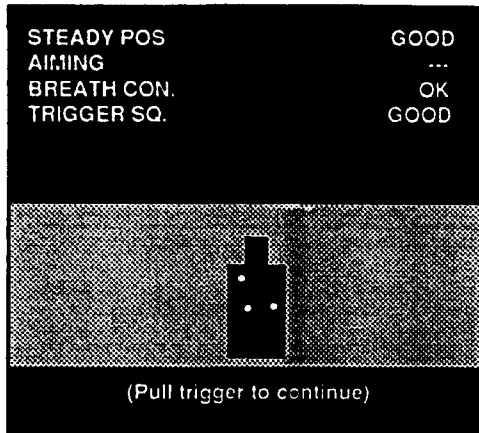
Graphic of target showing the spot locations of the three shots, now centered around the center of mass.

NOTE: No attempt is being made to assign the actual sequence number to each screen.

NOTE: For "Excellent" shot groups, the next screen is 1-1.

0-9

```



     Your shot group was good.

             Try for an
           excellent zero.



        (Pull trigger for targets)
```

NOTE: Force the shooter to try for an "Excellent" shot group, but after the third unsuccessful attempt, show screen 0-10.

0-10

```


       Your shot group was
            average.

        Try for a good or
        excellent group.



        (Pull trigger for targets)
```
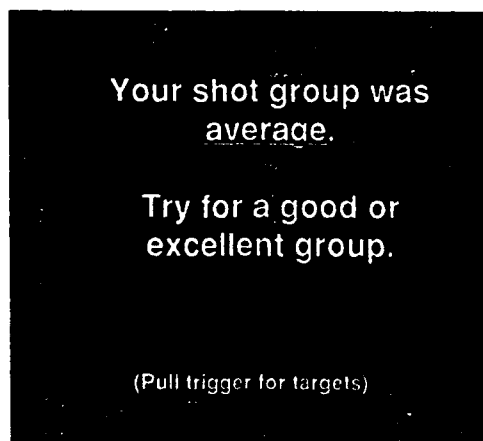
NOTE: Following the evaluation of a good or excellent group, screen
1-1 will be shown.

If a good or excellent group is not fired after a total of 6 groups, show 0-11 after each group.

0-11

Shot group average.
Would you like
to try for a
better zero?

YES   NO

POINT RIFLE AT ANSWER AND PULL
TRIGGER.
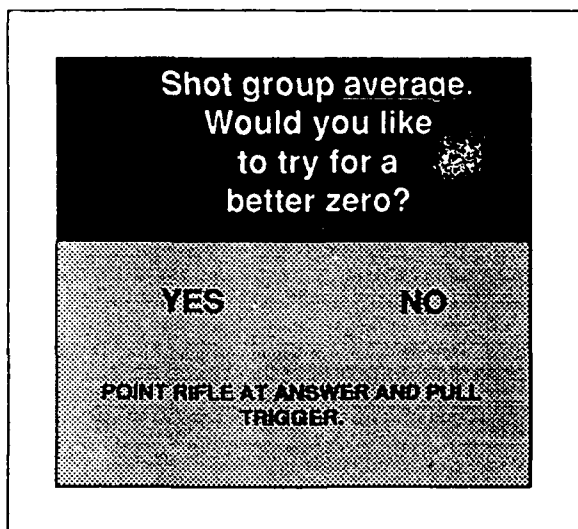
NOTE: Repeat this screen
until a good or excellent group
is obtained or "no" is selected.

1-1

LEVEL
1

Fundamentals - Stationary
Targets

(Pull trigger to continue)

1-2

4 Fundamentals of
Rifle Marksmanship

*Steady Position
*Aiming
*Breath Control
*Trigger Squeeze

(Pull trigger to continue)

1-3

Target Ranges

300

250

200

150

100

50

(Pull trigger to continue)
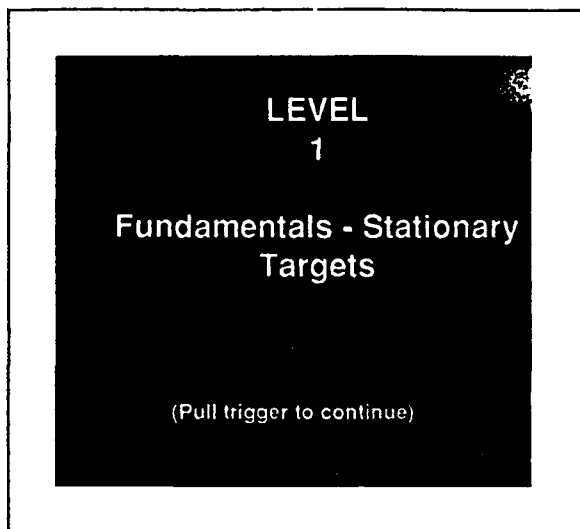
NOTE: Many screens can be lifted
directly from BRM.

1-3a

50

100

150

200

250

300
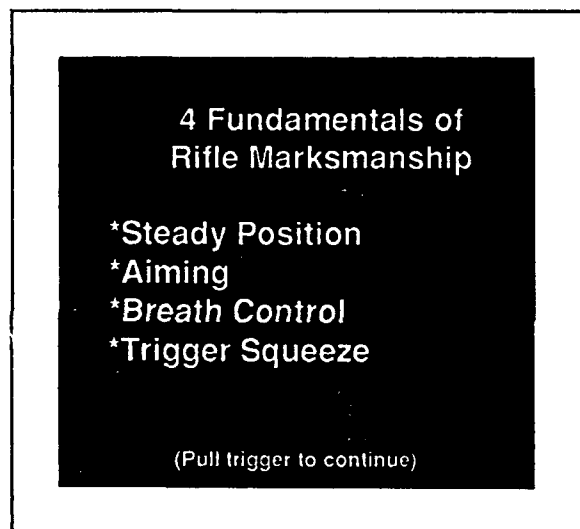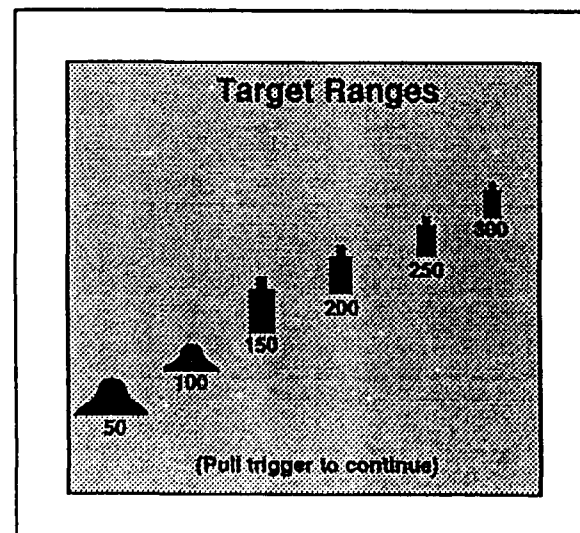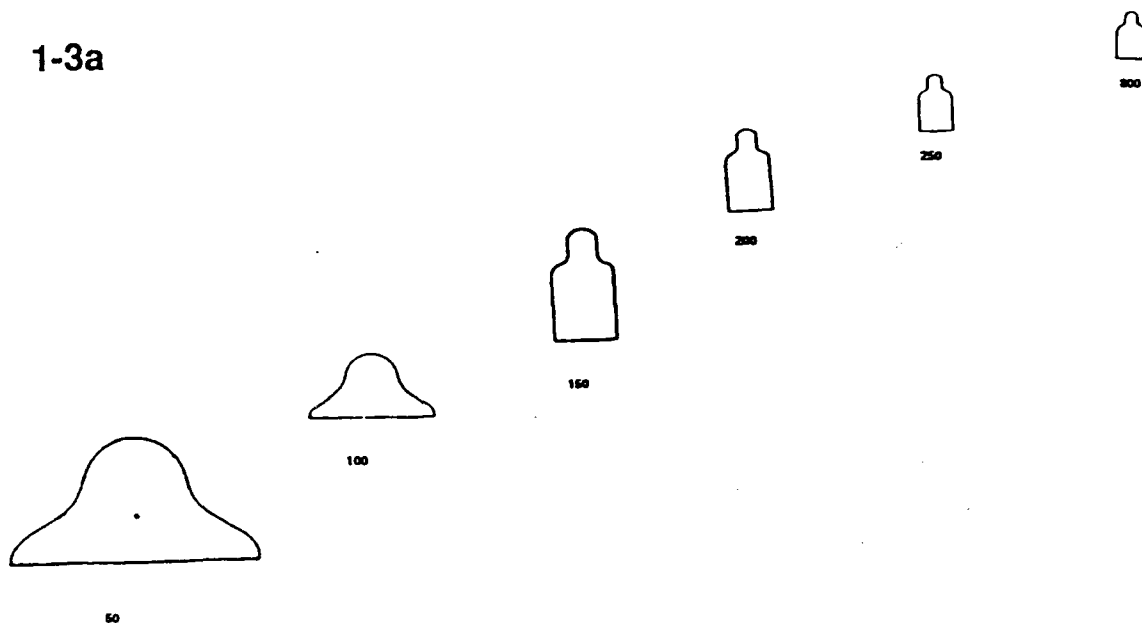
NOTE: Targets shown actual size
.hey will appear on MACS screen.

1-4

Performance is measured on this scale:

Excellent
Good
Average
Below Average
Poor

(Pull trigger to continue)

1-5

Targets are untimed
Standard: Hit 2 of 2
at each distance

ASSUME A
SUPPORTED
POSITION

Pull trigger for targets

1-6 to 1-31

L=1 T=1 R=0

HIT

MACS INFANTRY RIFLE MARKSMANSHIP (TELESCOPES)   30 August 1991   Page 10

A-10
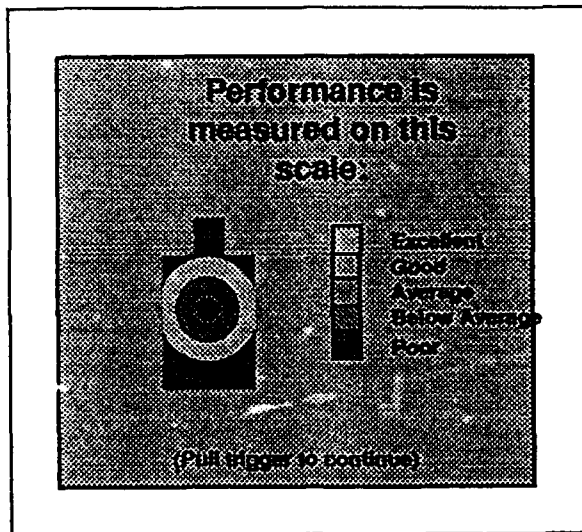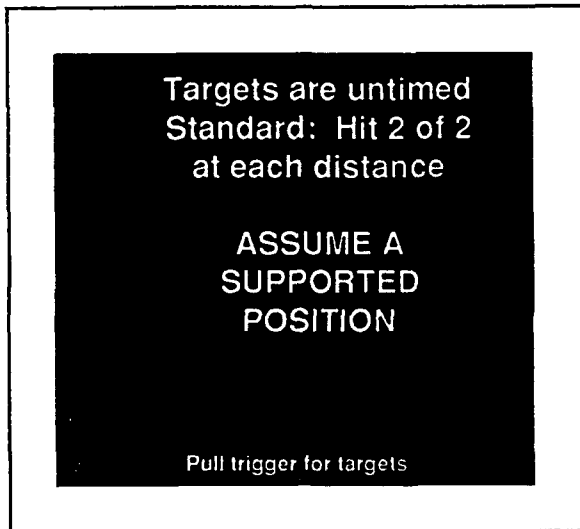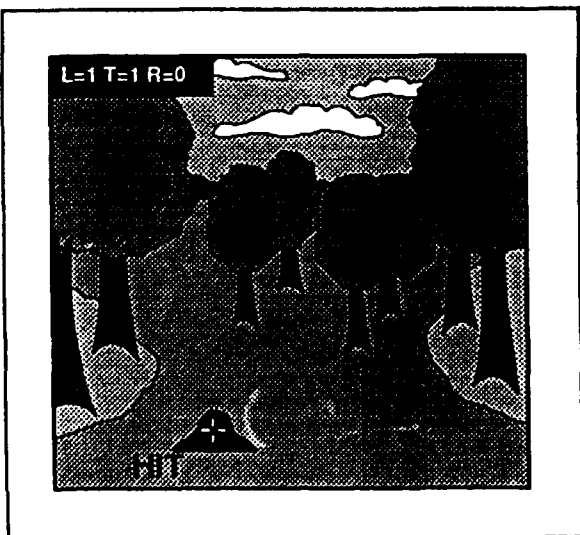
FEEDBACK SCREEN SEQUENCE

```
STEADY POS     GOOD
AIMING         GOOD
BREATH CON.      OK
TRIGGER SQ.  AVERAGE

REPLAY
         (Pull trigger to continue)
```

```
STEADY POS     GOOD
AIMING         GOOD
BREATH CON.      OK
TRIGGER SQ.  AVERAGE
SHOT LOC     AVERAGE

         (Pull trigger to continue)
```

```
STEADY POS     GOOD
AIMING         GOOD
BREATH CON.     OK
TRIGGER SQ.  AVERAGE
SHOT LOC     AVERAGE

         (Pull trigger to continue)
```

NOTE: For replay, show the correct sight placement below target center and show the bullet above point of aim as follows:

```
 50 M -  3.5 cm
100 M - 11.0 cm
150 M - 15.0 cm
200 M - 14.7 cm
250 M -  9.9 cm
300 M - Same
```

Detailed Feedback provided -- (use iron sights or the appropriate reticle)

-- and a
second
target,
followed by
the summary
and a 2-
target
summary
screen.

Here are your 2 shots.
50 meters

(Pull trigger to continue)

If a target is missed --

You did not meet
the standard.
Prepare to refire.

When standard is met --

Standard met

Continue.

1-32

Stationary Target
Evaluation Exercise

20 Timed Targets
20 Shots

Shot Location for Misses Only

Standard: Hit 15 of 20

(Pull trigger to continue)

1-33

ASSUME A
SUPPORTED
POSITION

Pull trigger for targets
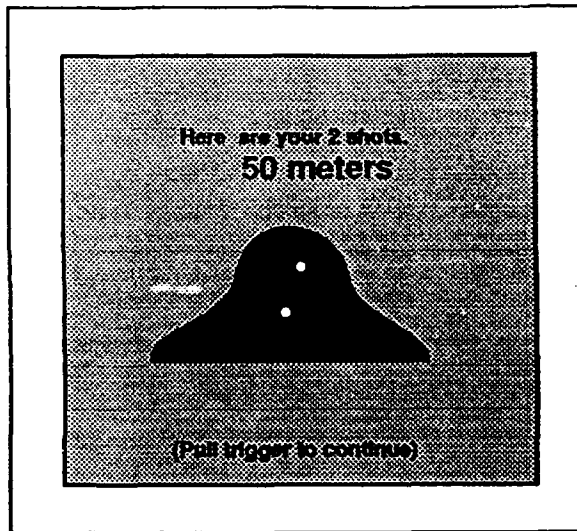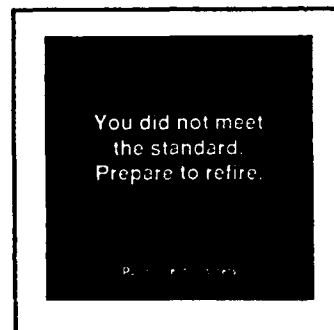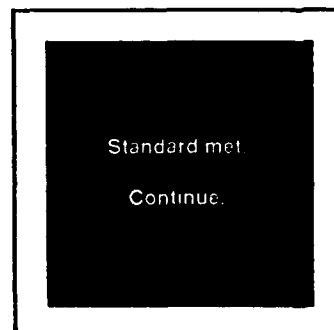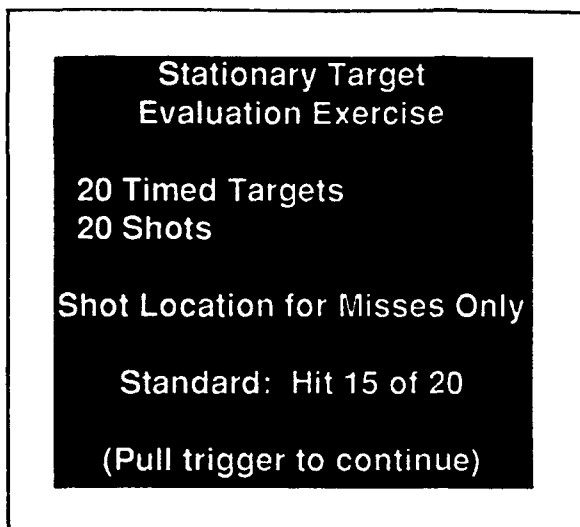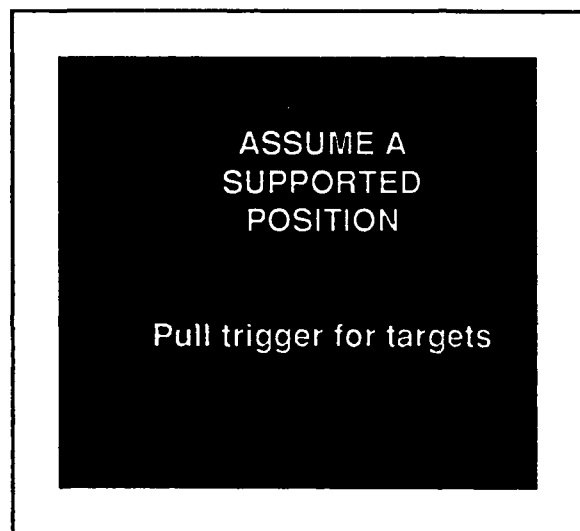
NOTE: Display 3 each of 50, 100, 150, and 200-meter targets and 4 each of 250 and 300-meter targets in a random fashion. Adjust exposure times to about 2, 3, 3, 4, 5, & 6 seconds for 10 single exposures and add times minus 25% for double exposures.

1-34 to 1-55
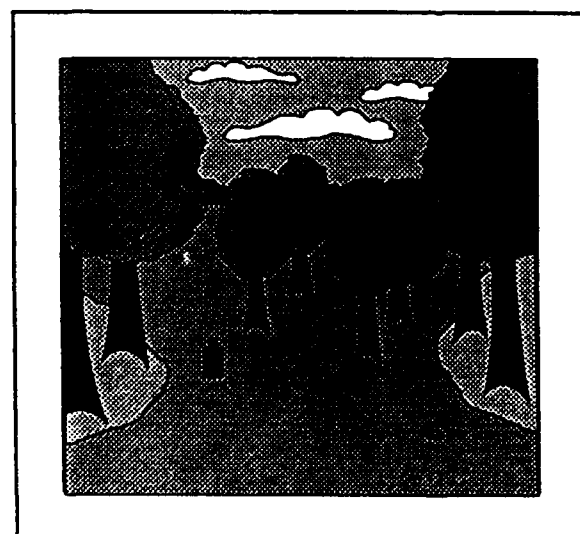
FIRING EXERCISE

1-51 to 1-56

Your Shots at
50 meters

(Pull trigger to continue)
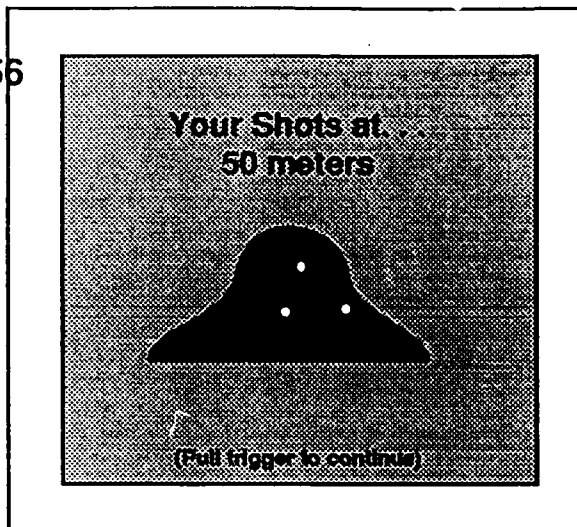
NOTE: Repeat this screen for 100, 150, 200, 250, and 300 meters.

1-57

Stationary Target
Evaluation Exercise

Standard: Hit 15 of 20

Your Score: 16 of 20

(Pull trigger to continue)

1-58

You did not meet
the standard.
Prepare to refire.

OR

2-1

LEVEL
2

Fundamentals - Moving
Targets

(Pull trigger to continue)

2-1

LEVEL
2

Fundamentals - Moving
Targets

(Pull trigger to continue)

2-1a

TARGET RANGES

MOVING

60   75   125   185

STATIONARY

50   100   150   250   300

2-2

You may miss moving targets by aiming at center mass, because the target continues moving as the bullet travels down range.

Without lead you miss
185 meters
6 mph lateral speed

(Pull Trigger to Continue)

NOTE: Many of these screens are a direct lift from the moving target program.

Graphic showing a miss when aiming center mass

2-3

To hit a target that is moving laterally across your front, you must aim ahead of target center. This is called LEAD.

With lead you hit
185 meters
6 mph lateral speed

(Pull Trigger to Continue)

2-4

The amount of lead needed to hit target center will increase when the target is farther away and or is moving faster laterally across your front.

(Pull Trigger to Continue)

2-5

To simplify target leads put the trailing tip of the front sight post at center of mass. This is the SINGLE LEAD RULE.

TRAILING TIP

CENTER MASS

75 meters
3 mph lateral speed

(Pull trigger to continue)

NOTE: When different words are needed for iron and reticles they will always be in this sequence: (iron) or (ELCAN reticle) or (ARI reticle).

Graphic defining center of mass, and (trailing tip of the front sight post) or (first lead) or (trailing first hash mark; and then showing the proper single lead rule sight placement.

2-6

Notice how the single lead rule works automatically as the target gets smaller (is farther and farther away).

(Pull trigger to continue)
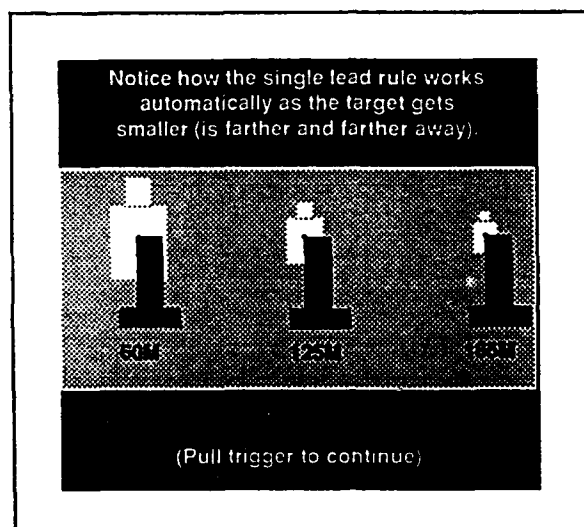
Graphic of 60m, 125m, and 185m targets showing how the single lead rule advances the center of the sight farther and farther forward on the target

2-7

Two ways to engage moving targets are tracking & trapping. You will get to try both methods to see how they work.

(Pull trigger to continue)

2-8

To track, get the correct lead and move your rifle with the target as you squeeze the trigger.

This is a track.
75 meters
3 mph lateral speed

(Pull trigger to continue)
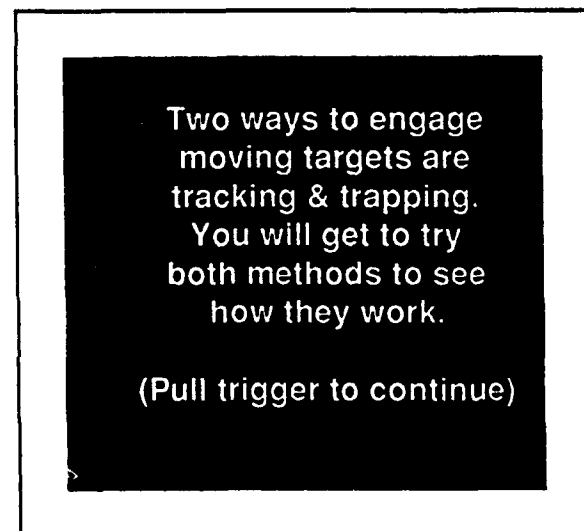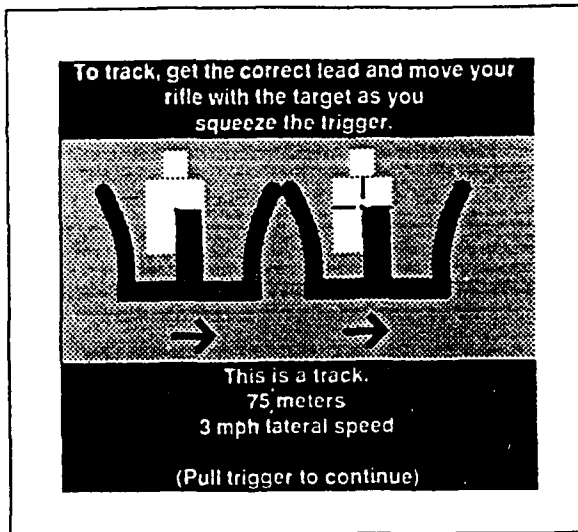
Graphic showing a proper smooth tracking sequence

2-9

Fundamentals for
Tracking
Moving Targets

*Smooth Track
*Lead
*Breath Control
*Trigger Squeeze

(Pull trigger to continue)

2-10

5 targets
Feedback after each
shot
Standard:
Smooth track and
proper lead on
3 of 5 targets

Pull trigger for targets

**·11,
-15**

```
SMOOTH TRACK          EXCELLENT
LEAD                       GOOD
BREATH CON.                  OK
TRIGGER SQ.                GOOD



              (Pull trigger to continue)
```
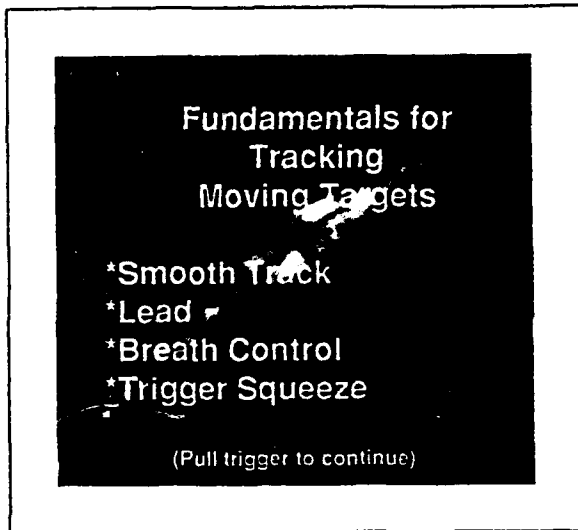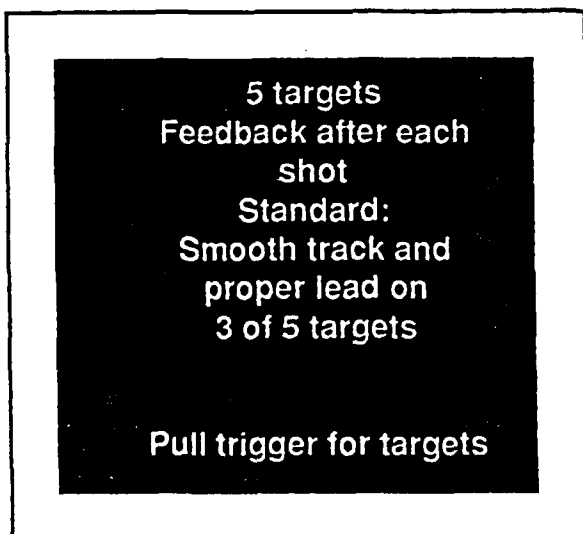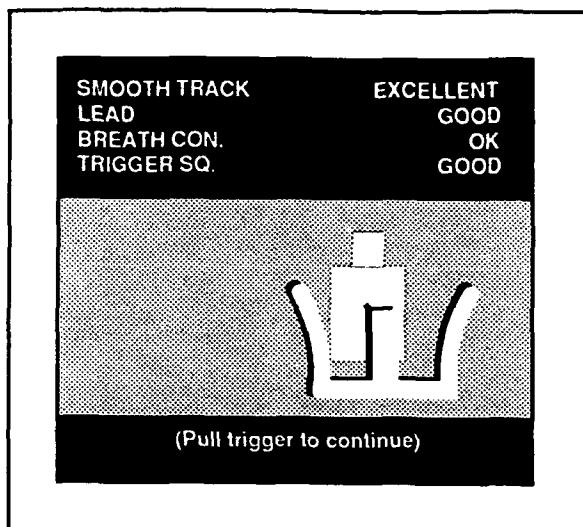
Five 75-meter targets moving at 3 mph from left to right with replay after each shot.

-16

```
          Your 5 shots
           75 meters
           3 mph  →



        (Pull trigger to continue)
```
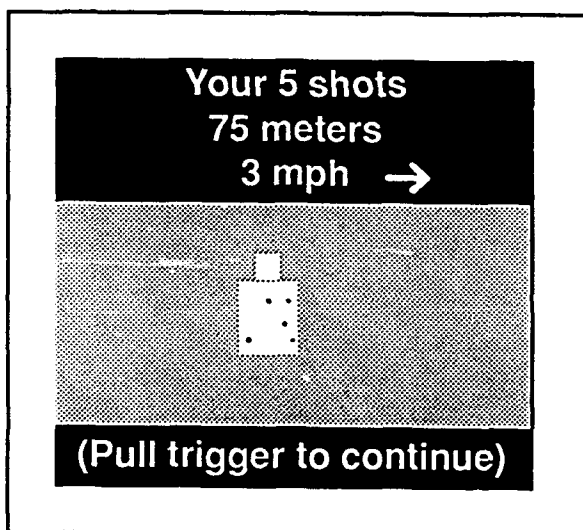
Summary screen showing 5 shots.

NOTE: Beginning here and wherever summary screens are given, the results should be separated by direction of target movement, wind direction, and combinations of these (if any) so mistake trends can be more clearly seen by the shooter.

-17

```
             Summary
        Standard:  Good or
       Excellent Track and
          Lead on 3 of 5
             targets
          Your Score:
       Smooth Track - 4 of 5
          Lead - 3 of 5

       (Pull trigger to continue)
```

2-18

On the last target
you trapped. Try to
track every target
for the rest of this
practice exercise.

Pull trigger for targets
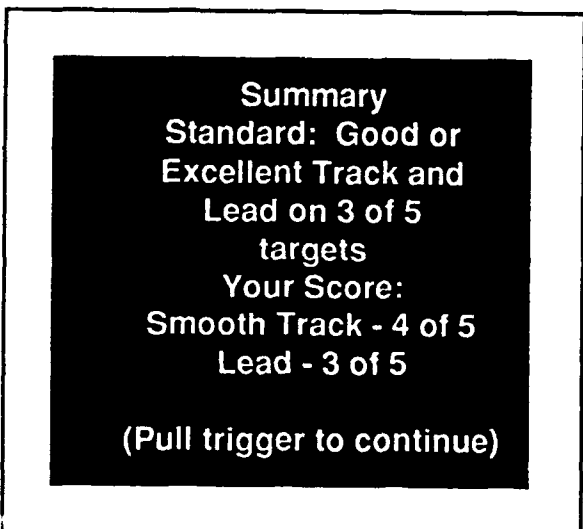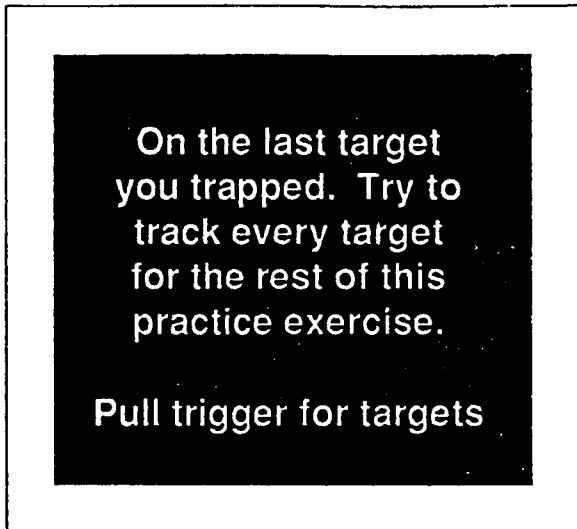
NOTE: If at any time the person does not track (traps instead), give this screen.

NOTE: When this occurs, cycle back to the same target.

2-19

You did not meet
the standard.
Prepare to refire.

(Pull Trigger to Continue.)
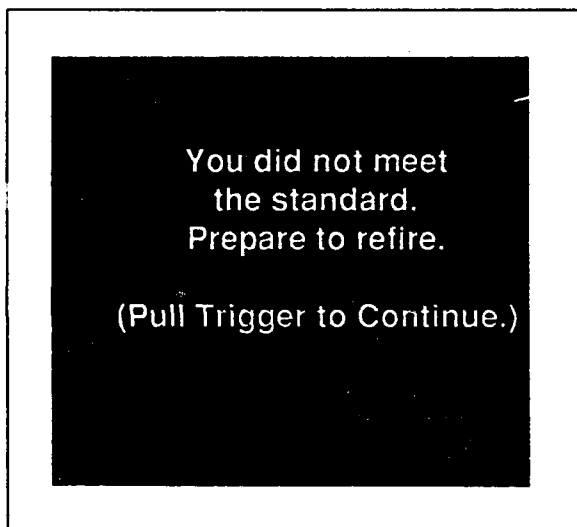
If the standard is not met, display this screen:

For a smooth track,
move your rifle at
the same speed as
the target, trying
to keep the trailing
tip of the front
sight post at
target center mass.

Pull trigger for targets.

Following 2-19., provide this screen and then repeat the five targets.

(trailing tip of the front sight post) or (first lead) or (trailing first hash mark).

To trap, establish a steady position in front of the target and pull the trigger when the target gets to the right spot.

This is a trap.
75 meters
3 mph lateral speed
(Pull trigger to continue)
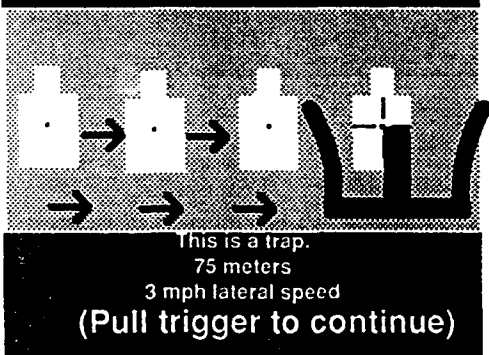
Graphic howing a proper trap sequence

Fundamentals for
Trapping
Moving Targets

*Steady Position
*Lead
*Breath Control
*Trigger Pull

(Pull trigger to continue)

2-23

5 targets
Feedback after each
shot.
Standard:
Apply proper trap
lead for 3 of
5 targets

Pull trigger for targets.

2-24

STEADY POS   EXCELLENT
LEAD   GOOD
BREATH CON.   OK
TRIGGER PULL   GOOD

(Pull trigger to continue)
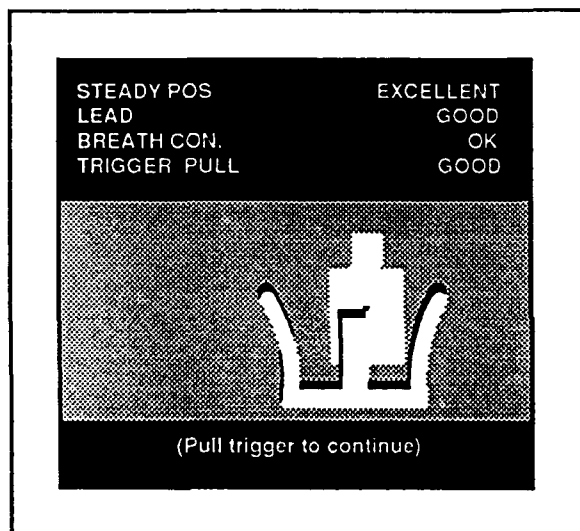
Five 75-meter targets moving at 3 mph from right to left, with replay after each shot.

2-25

,Your 5 shots
75 meters

(Pull trigger to continue)
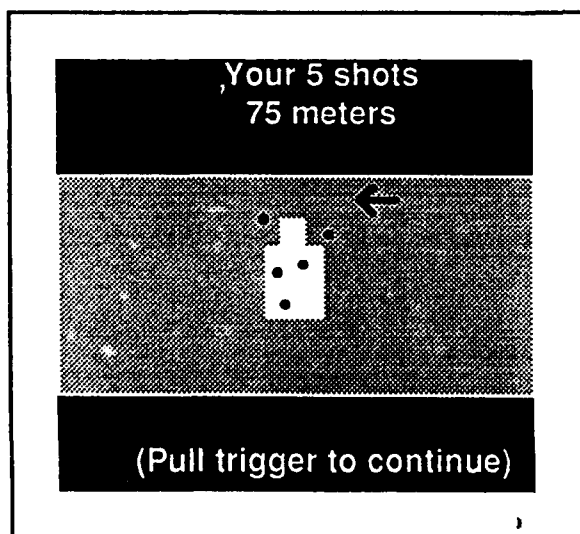
Target with five shots. (2-16.)

2-26

Summary
Standard: Good or
Excellent lead on
3 of 5 targets.
Your score: 3 of 5

(Pull trigger to continue)
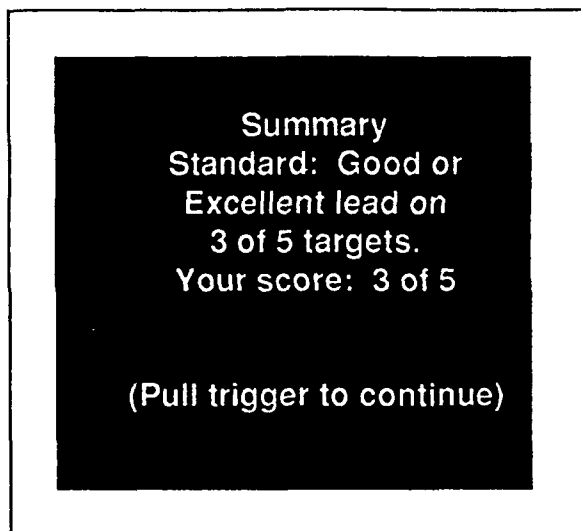
Following the summary, if a person has not met the standard, display 2-27.

2-27

You did not meet
the standard.
Prepare to refire.

(Pull Trigger to Continue.)

2-28

To trap, aim ahead
and wait for target
center mass to reach
the nearest edge of
the front sight post.

Pull trigger for targets
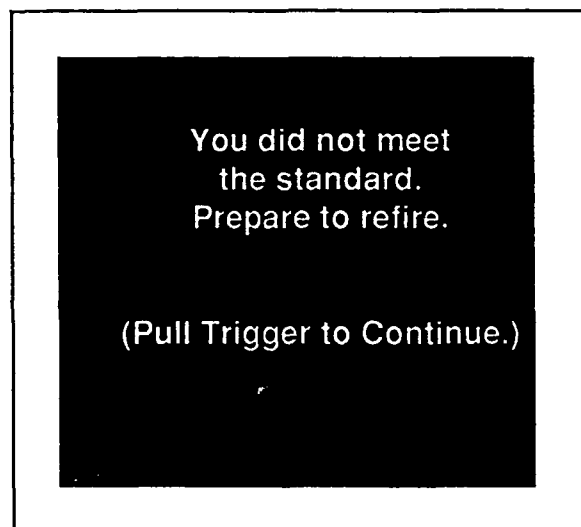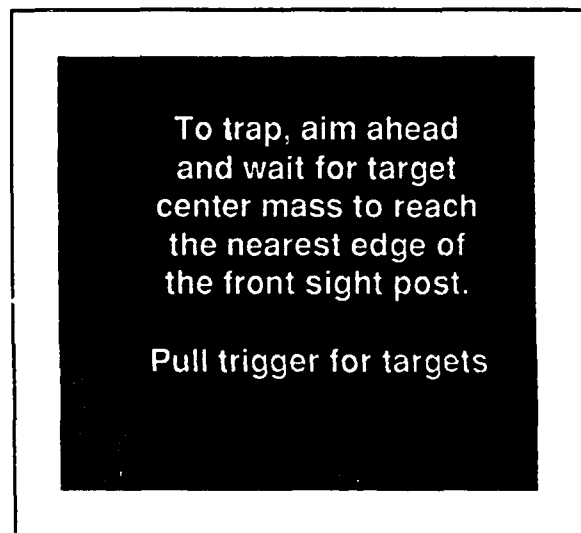
(nearest edge of the front sight post) or (first lead) or (nearest hash mark before center).

2-29

On the last target
you tracked. Try to
trap every target
for the rest of this
practice exercise.

Pull trigger for targets
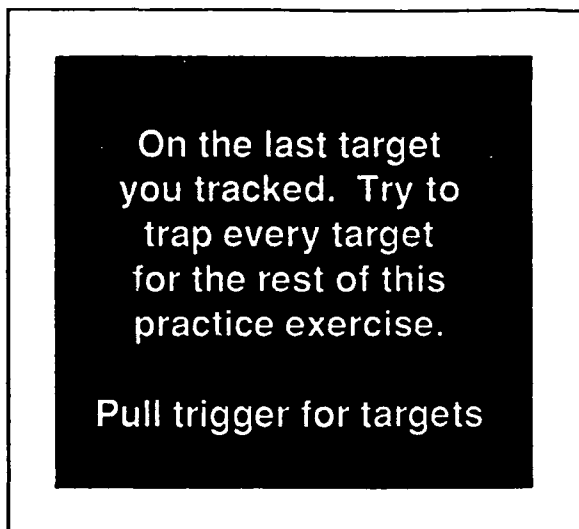
NOTE: If at any time the
person does not trap (tracks
instead), give this screen:

NOTE: Cycle back to the
same target.

2-30

For the remainder
of this program
you may either track
or trap targets.
In harder exercises
many shooters find
it works best to mix
use of both methods.

(Pull trigger to continue)

2-31

21 targets
Feedback after each
shot
Standard:
Hit 2 of 3 targets
at each range and speed.

Pull trigger for targets.
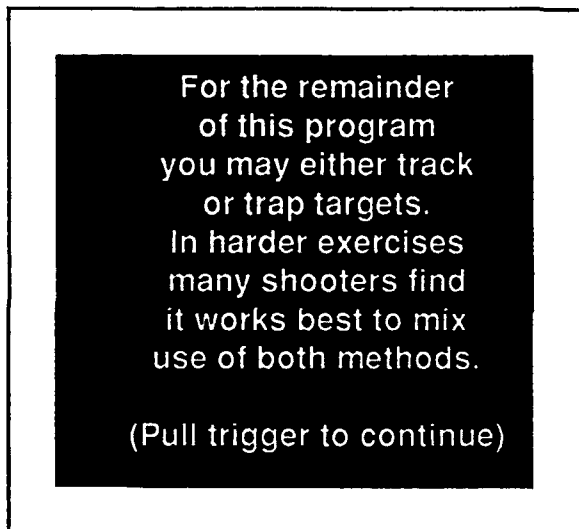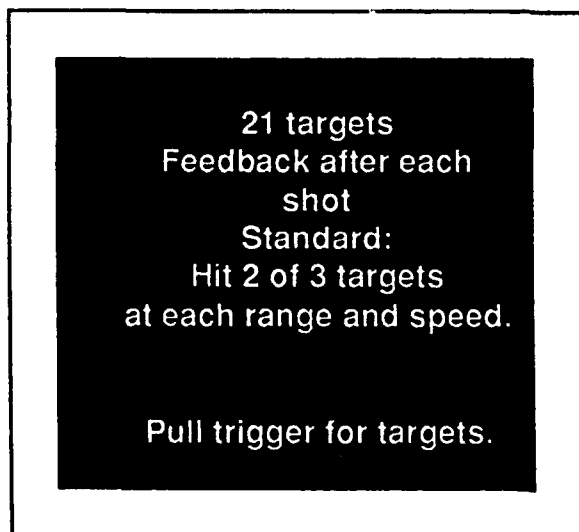
NOTE: 21 target presentation

Range	Direction	Speed	# Total
60	L to R	S, M, F	9
75	R to L	F	3
125	L to R	S F	6
185	R to L	M	3
			21

Your 3 shots
60 meters
3 mph →

(Pull trigger to continue)
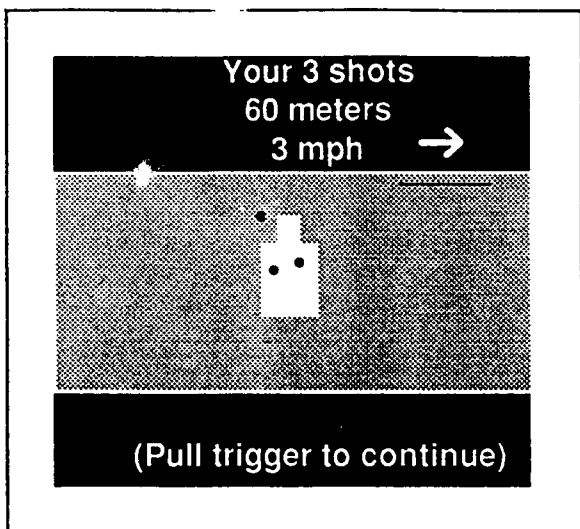
Graphic scene and moving target presentation of 21 targets with playback.

After each three shots, this summary is shown.

Failure to meet the standard gives this screen and requires a repeat of the three shots:

You did not meet
the standard.
Prepare to refire.

(Pull Trigger to Continue.)
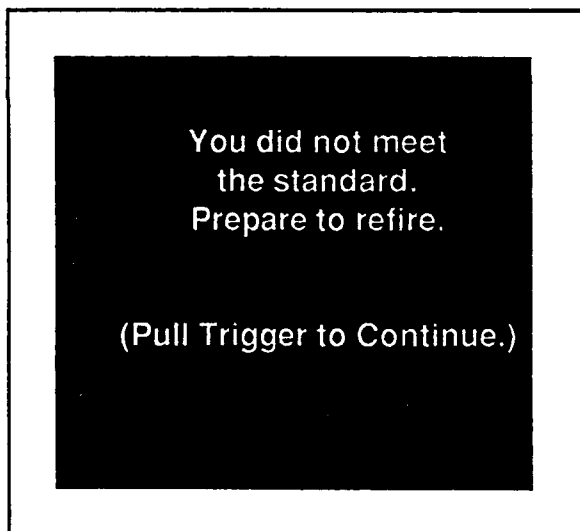
2-52

```
SUMMARY: 21-TARGET EXERCISE

NUMBER OF TARGETS TRACKED -- 10
SMTH TRACK              GOOD
LEAD                    GOOD
BREATH CON                OK
TRIGGER SQ              GOOD
SHOT LOC               GOOD

NUMBER OF TARGETS TRAPPED -- 6
STEADY POS         EXCELLENT
LEAD           BELOW AVERAGE
BREATH CON                OK
TRIG PULL              GOOD
SHOT LOCATION   BELOW AVERAGE

       (Pull trigger to continue)
```

2-53

```
       20 timed targets.
          20 shots.
       Shot location for
          misses only.


           Standard:
        Hit 4/5 stationary
        Hit 11/15 moving


      Pull trigger for targets.
```

NOTE: 20 target presentation

Range	#	Exp* Time	Speed
50S	1	2 sec	
60M	4		S, M, F, F
75M	4		M, M, F, F
100S	1	3 sec	
125M	4		S, M, F, F
150S	1	3 sec	
185M	3		S, M, M
250S	1	4 sec	
300S	1	5 sec	

*Expose while a target is moving - leave up for
this time - after the moving target is gone.

2-54,
2-74

Graphic scene with stationary and
moving target presentation sequence -
- Level 2.

NOTE: OUT OF AMMO appears
when shot allowance is expended.

2-75

Upon completion of the scenario,
this screen is shown.

NOTE: Failure to qualify requires a
complete scenario refire, shows the
word UNQUALIFIED and gives the
following screen:

You did not meet
the standard.
Prepare to refire.

Pull trigger for targets.

3-1
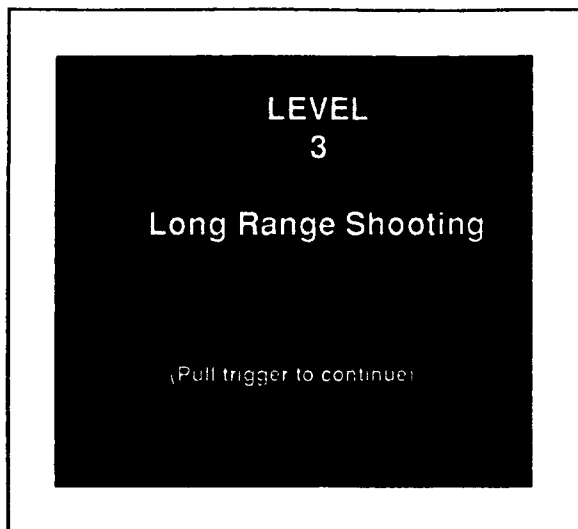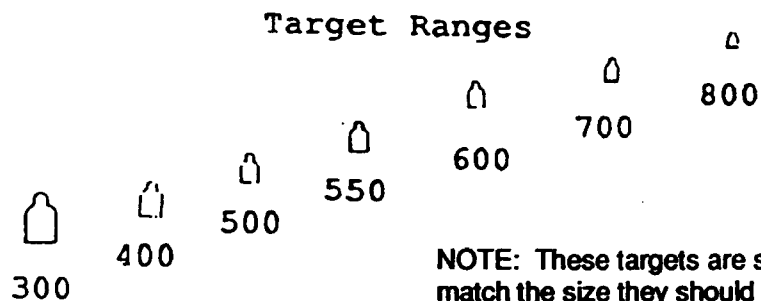
LEVEL
3

Long Range Shooting

(Pull trigger to continue)

3-2

Target Ranges

800

700

600

550

500

400

300

NOTE: These targets are scaled to match the size they should appear on the MACS screen.
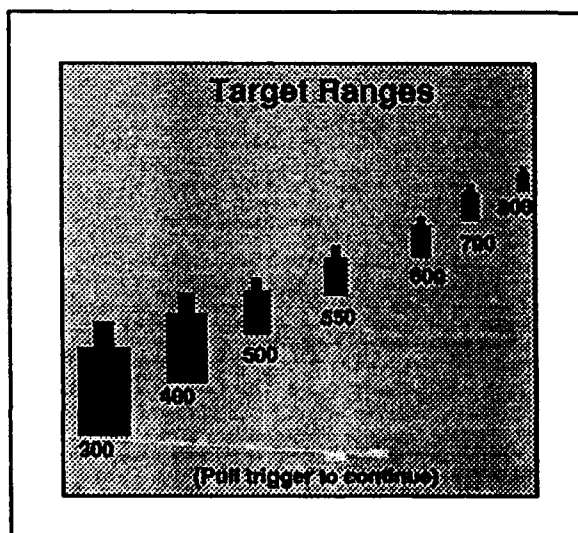
Target Ranges

3-3

Shooting at long range is a much more difficult task than shooting at short range.

(Pull trigger to continue)

3-4

If you miss a 200 M target, you did something wrong. If you miss a 500 M target, the cause may be the rifle, ammo, wind, sight setting, other factors, or you.

(Pull trigger to continue)

3-5

Shooting fundamentals are the same for long range targets as they are for short range targets. but you must apply the fundamentals with more care to hit long range targets.

(Pull trigger to continue)

3-6

Knowing the distance
to targets at long
range is important.
Sights and targets
in this program are
scaled accurately.
Note the size of the
sight and target at
all ranges.

(Pull trigger to continue)

3-7

*Targets are untimed.
*Rifle Sights: Setting
  shown for each exercise.
*No wind.
*Fire from a supported
  position.

(Pull trigger to continue)

3-8

*Target Range: 300 Meters
*Rifle Sights Set at 300
  Meters
*Standard: Hit 4 of 5

Pull trigger for targets

3-9

Scene with 300 M target.

3-10
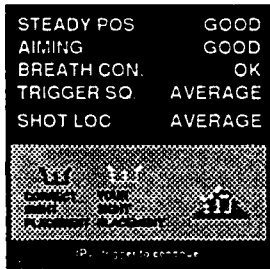
Graphic of target with correct sight and your sight.

STEADY POS.   GOOD
AIMING   GOOD
BREATH CON.   OK
TRIGGER SQ.   AVERAGE
SHOT LOC   AVERAGE
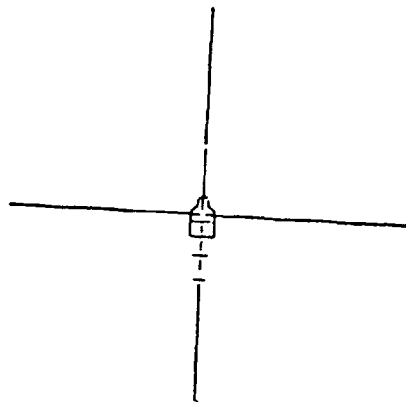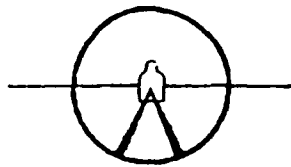
NOTE: Make the criterion for EXCELLENT and GOOD tighter - by about 40%. Repeat 3-9 and 3-10 four times.

-11
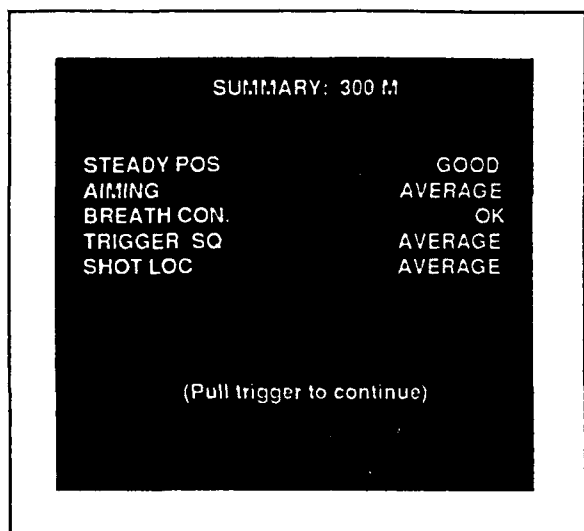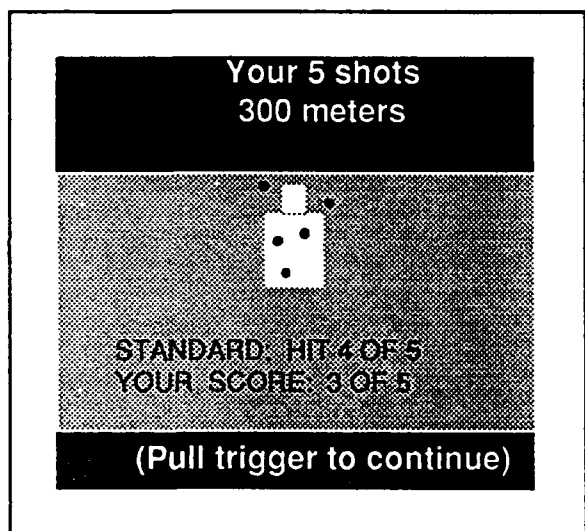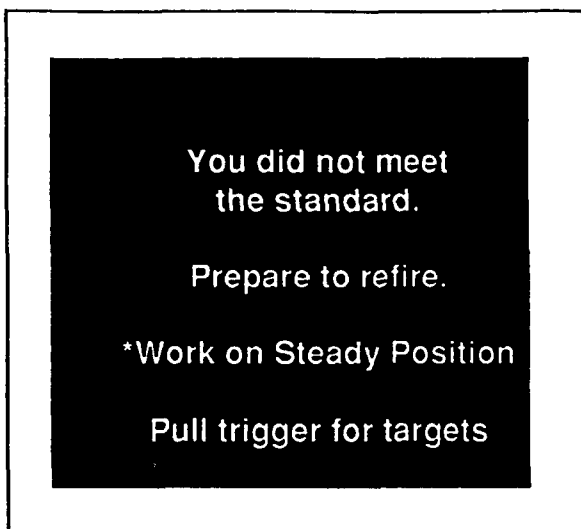
```
            SUMMARY: 300 M


STEADY POS                    GOOD
AIMING                     AVERAGE
BREATH CON.                     OK
TRIGGER SQ                 AVERAGE
SHOT LOC                   AVERAGE




         (Pull trigger to continue)
```

-12

```
              Your 5 shots
              300 meters




        STANDARD: HIT 4 OF 5
        YOUR SCORE: 3 OF 5

        (Pull trigger to continue)
```

3-13

You did not meet
the standard.

Prepare to refire.

*Work on Steady Position

Pull trigger for targets

NOTE: After the third set of 5 targets, show the following.:

3-14

You did not meet
the standard.

You need to work on
Trigger Squeeze

REFIRE   ADVANCE
300 M   TO 400M
TARGETS   TARGETS

[POINT RIFLE AT CHOICE AND PULL
TRIGGER.]
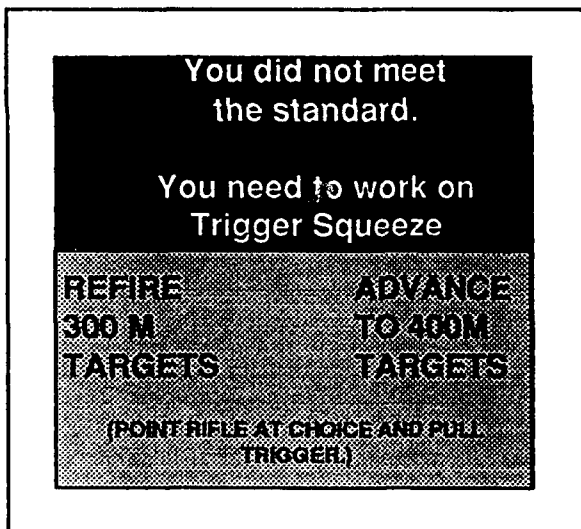
Use this procedure on most of the remaining exercises.

-15

16   (400 Meters)

3-23   (Same as 300 Meters)

3-24

*Target Range: 500 Meters
*Rifle Sights Set at 500
  Meters
*Standard: Hit 2 of 5

Pull trigger for targets

3-25   (500 Meters)
to 3-31   (Same as 300 Meters)

3-32

*Target Range: 600 Meters
*Rifle Sights Set at 600
 Meters
*Standard: Hit 1 of 5

Pull trigger for targets
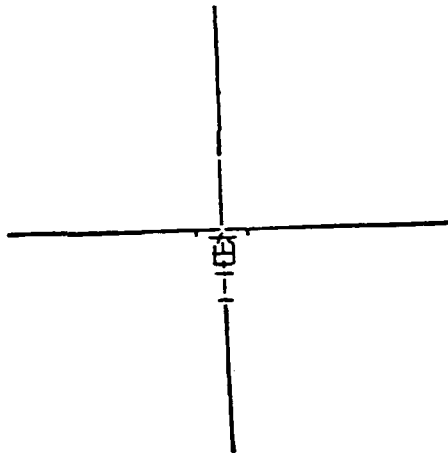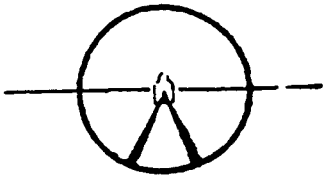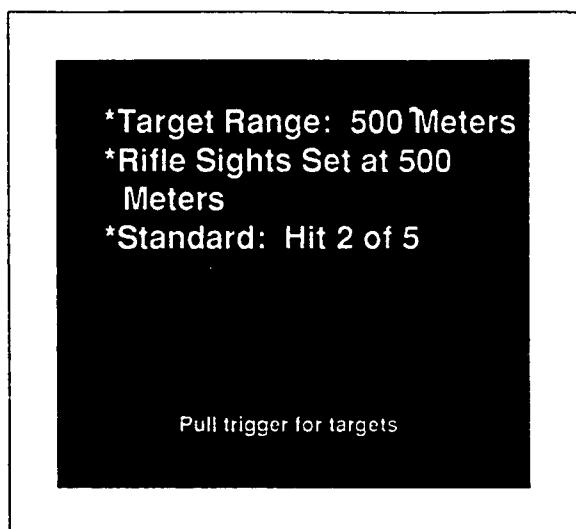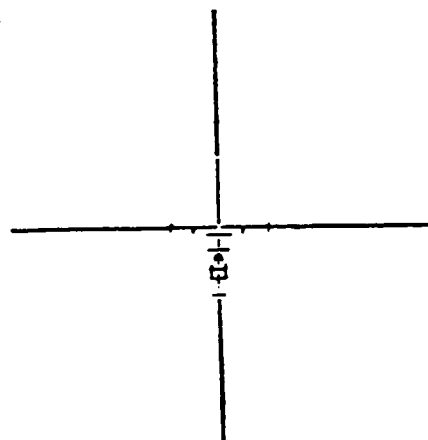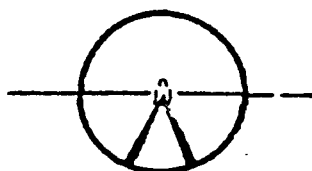
3-33   (600 Meters)
to 3-39   (Same as 300 Meters)
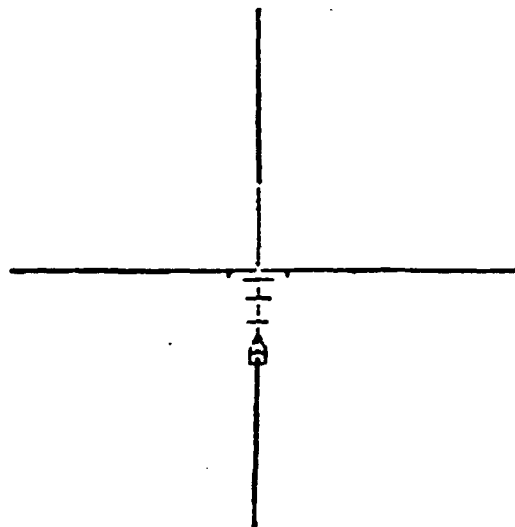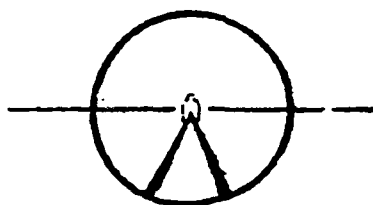
3-40

Suppressive fire can
be valuable in com-
bat. Don't expect to
hit targets at 700
or 800 meters -- just
coming close may de-
lay an enemy or
disrupt an attack.

Pull trigger for targets

NOTE: When iron sights have been selected, skip to 3-47.

3-41

*Target Range: 700 Meters
*Rifle Sights Set at 700
  Meters
*Standard: Suppressive
Fire

Pull trigger for targets

3-42

700 M targets (show "Miss" only -- no replay)

3-43

Here are your 5 shots
at 700 meters.

(Pull trigger to continue)
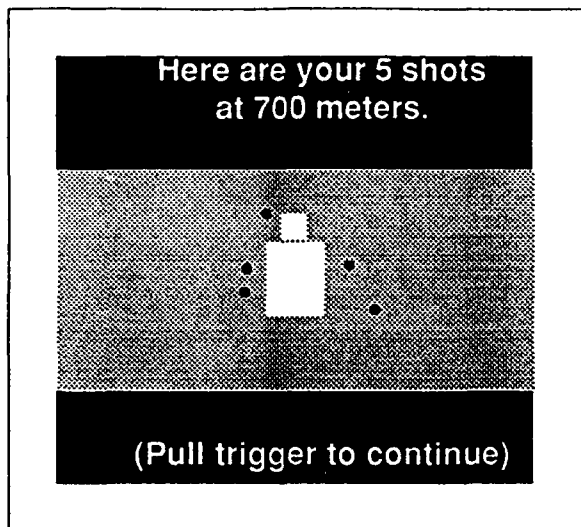
Target with 5 missed shots.

3-44

*Target Range: 800 Meters
*Rifle Sights Set at 800 Meters
*Standard: Suppressive Fire

Pull trigger for targets

3-45   (800 Meters)
to 3-46 (Same as 700 Meters)

3-47

You should always keep your sights set on battlesight zero unless you are shooting a specific target. Many times you will not have time to change sights, and must adjust your aim point.

(Pull trigger to continue)

3-48

*Target Range: 400 Meters
*Rifle Sights Set at 300 Meters
*Standard: Hit 2 of 5

Pull trigger for targets

NOTE: Need to highlight 400 and 300 - maybe blink?

3-49
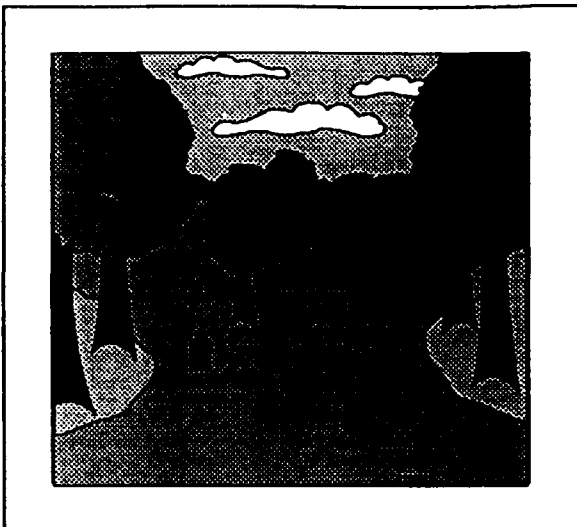
400 M targets

NOTE: Bullet hits 38 cm below the aiming point for the iron and ELCAN sights. The ARI sight has the 400 M aiming ⸳ ⸳rk at target center, which is th ⸳ ⸳⸳llet strike point.

Detailed replay.
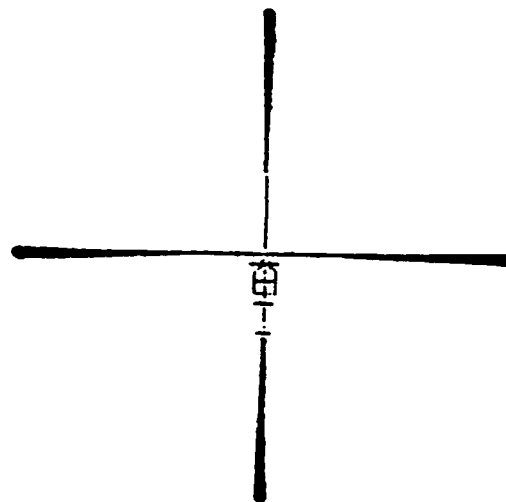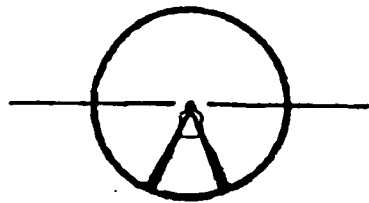
NOTE: Show range and sight setting on replay.

3-50

Here are your 5 shots
at 400 meters.

Sights set at 300 M

(Pull trigger to continue)
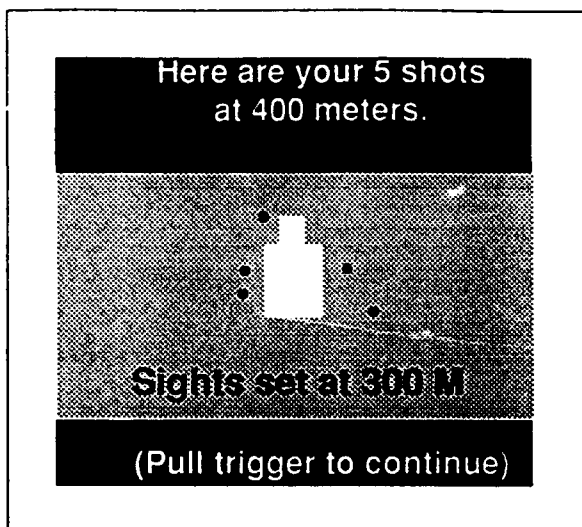
NOTE: After 5 targets

Replay 5 shots at 400 M -- Reshoot
400 M if 2 of 5 not hit.

3-51

*Target Range: 500 Meters
*Rifle Sights Set at 300
 Meters
*Standard: Hit 1 of 5

Pull trigger for targets
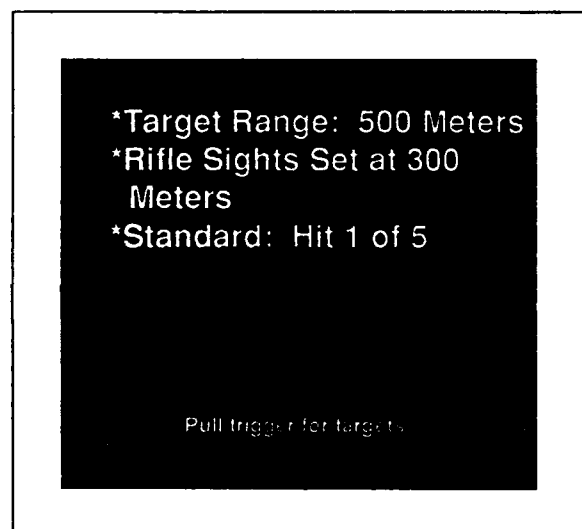
NOTE: Need to highlight 500 and
300 .

3-52
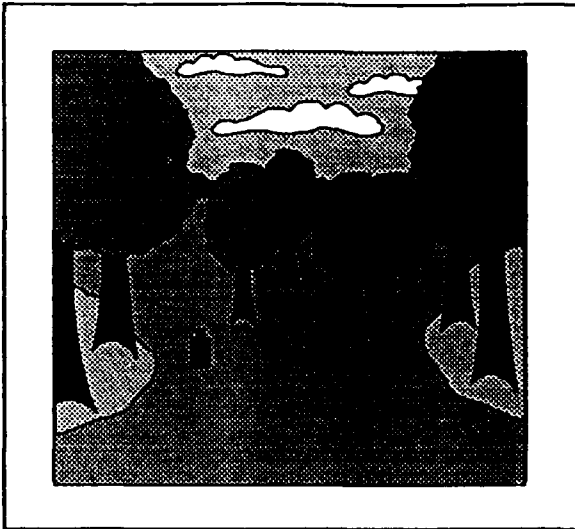
500 M targets

NOTE; Offset is 97 cm.

3-53

3-54

Here are your 5 shots
at 500 meters.

Sights set at 300 M

(Pull trigger to continue)
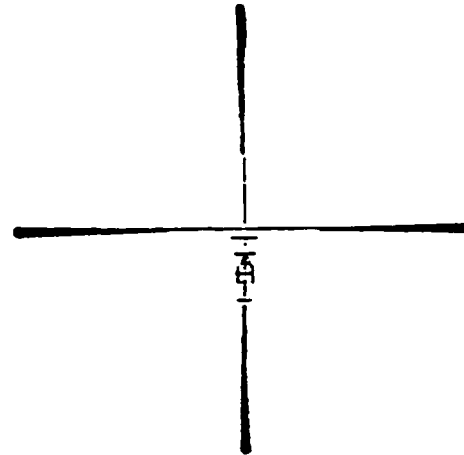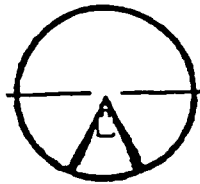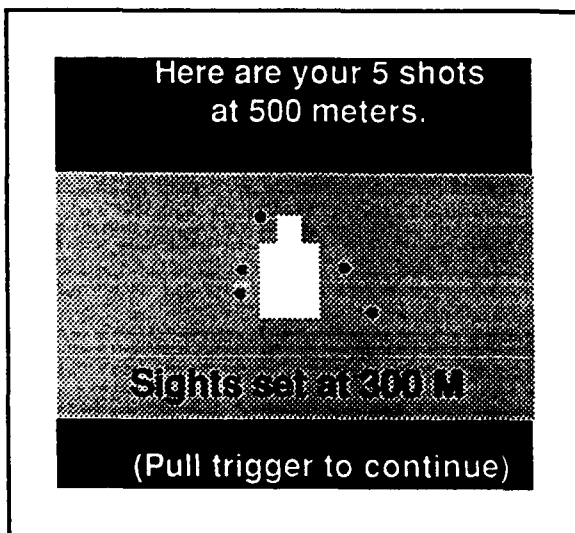
NOTE: After 5 targets

Replay 5 shots at 500 M -- Reshoot
500 M if 1 of 5 not hit.

3-55

With sights set for
long range targets,
you may need to
engage a single
shorter range target
without making a
sight change.

(Pull trigger to Continue)

3-56

*Target Range: 300 Meters
*Rifle Sights Set at 500
  Meters
*Standard: Hit 2 of 5

Pull trigger for targets

NOTE: Need to highlight <u>300</u> and <u>500</u>

3-57
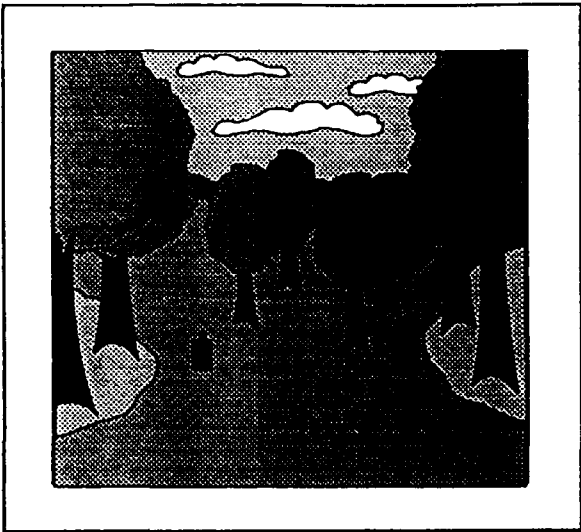
300 M targets

NOTE: Bullet hits 58 cm <u>above</u> aim point.

3-58

Detailed replay.

3-59

Here are your 5 shots
at 300 meters.

Sights set at 500 M

(Pull trigger to continue)
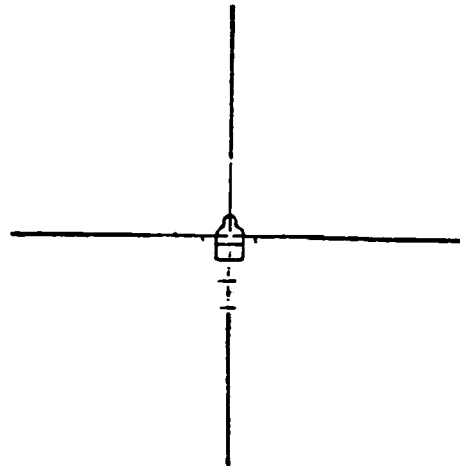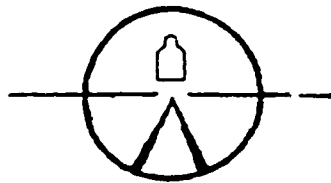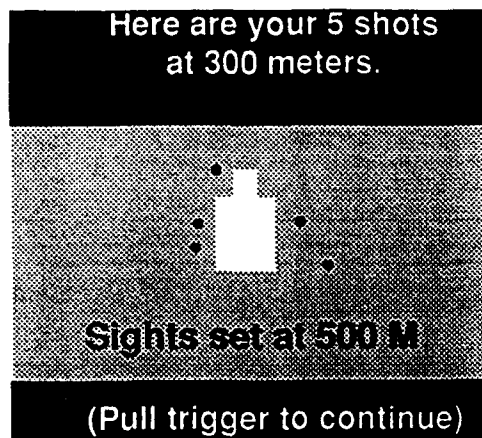
NOTE: After 5 targets

Replay 5 shots at 300 M -- Reshoot
400 M if 2 of 5 not hit.

3-60

The listed maximum
effective range of
the M16A2/A3 is
550 M. Practice
shooting a 550 M
target with a
sight setting of 500
and 600 meters.

(Pull trigger to Continue)

3-61

*Target Range: 550 Meters
*Rifle Sights Set at 500
 Meters
*Standard: Hit 1 of 5

Pull trigger for targets
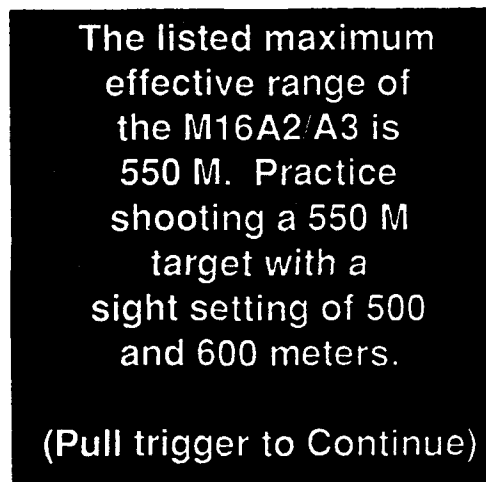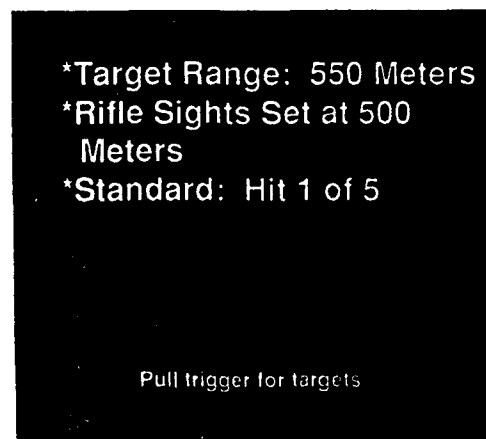
NOTE: Need to highlight 550 and
500

3-62

550 M targets

NOTE: Bullet hits 40 cm below aim point.

3-63

Detailed replay.
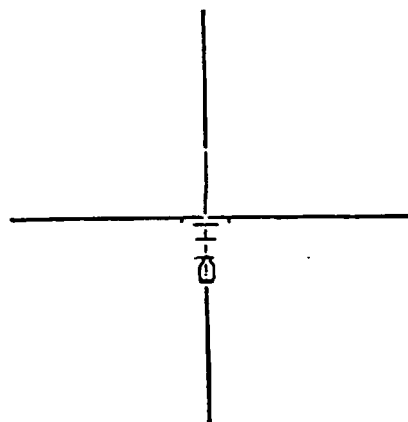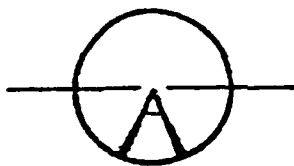
3-64
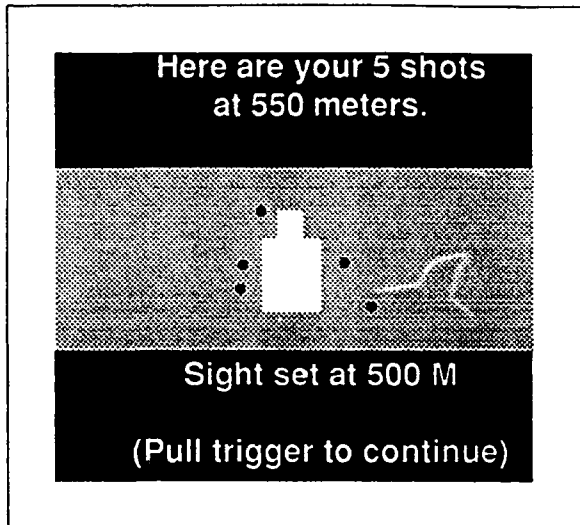
Here are your 5 shots
at 550 meters.

Sight set at 500 M

(Pull trigger to continue)

NOTE: After 5 targets

Replay 5 shots at 550 M -- Reshoot
if 1 of 5 not hit.

3-65

*Target Range: 550 Meters
*Rifle Sights Set at 600
 Meters
*Standard: Hit 1 of 5

Pull trigger for targets
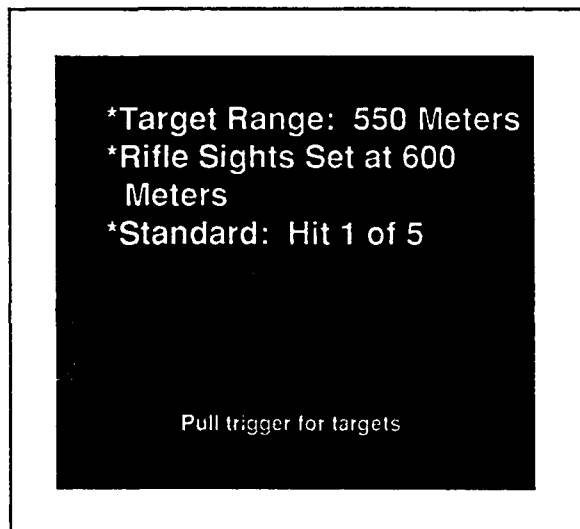
NOTE: Need to highlight 550 and
600

3-66   NOTE: Bullet hits 38 cm above aim
point.
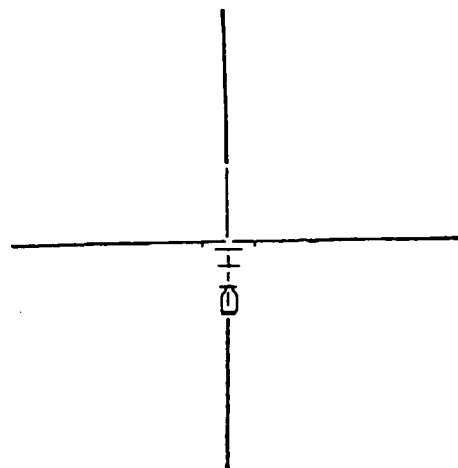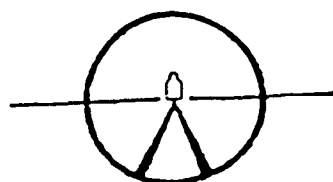
3-67
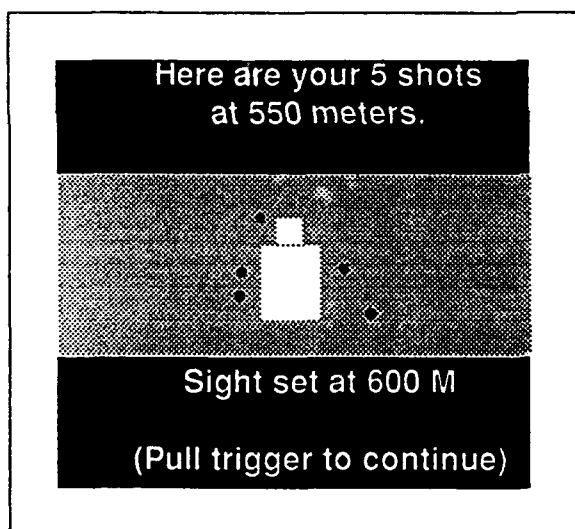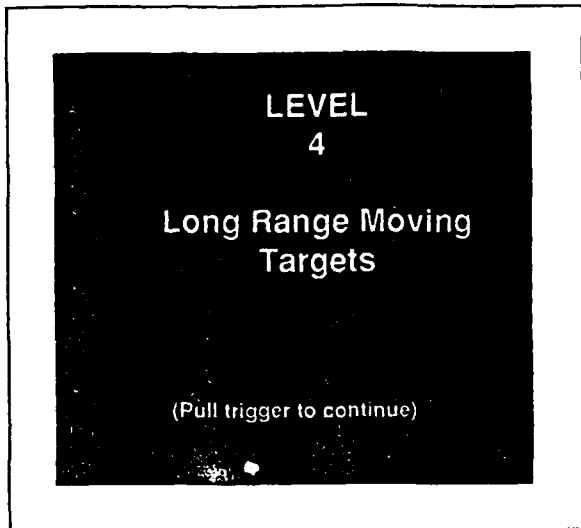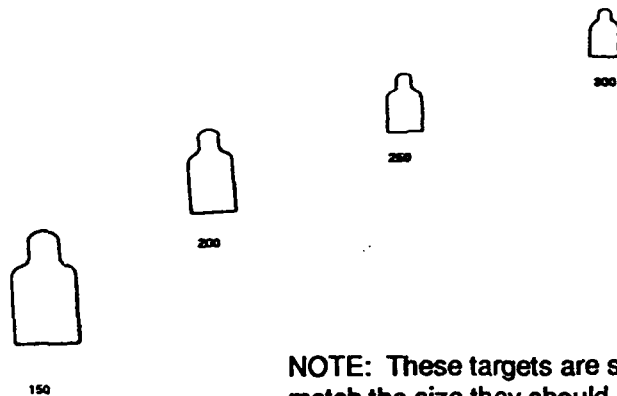
Here are your 5 shots
at 550 meters.

Sight set at 600 M

(Pull trigger to continue)

NOTE: After 5 targets

Replay 5 shots at 550 M -- Reshoot
if 1 of 5 not hit.

4-1

LEVEL
4

Long Range Moving
Targets

(Pull trigger to continue)

4-2

300

250

200

150

NOTE: These targets are scaled to match the size they should appear on the MACS screen.

Target Ranges

300

250

200

150

(Pull trigger to continue)
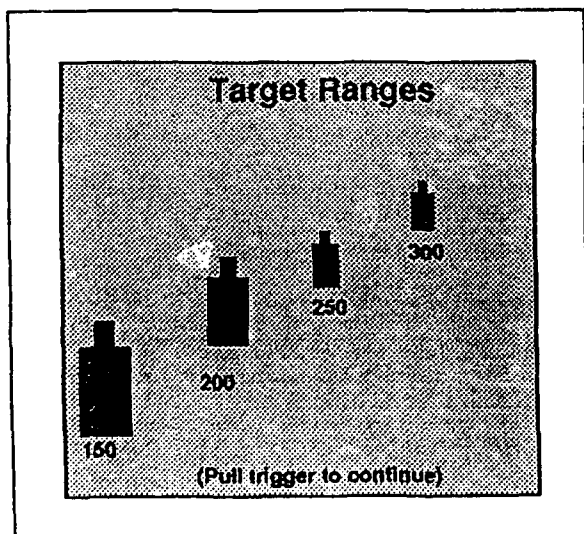
4-3

The single lead rule
will hit all targets
within 125 m and all
targets with lateral
movement equal to
a walking person
at all ranges.

(Pull trigger to continue)

4-4

LONG RANGE
MOVING TARGET PRACTICE
(Single Lead Rule)

Standard:
Hit 4 of 5 at 150 meters.
Hit 3 of 5 at 200 meters.
Hit 2 of 5 at 250 meters.
Hit 1 of 5 at 300 meters.

Pull trigger for targets

4-5
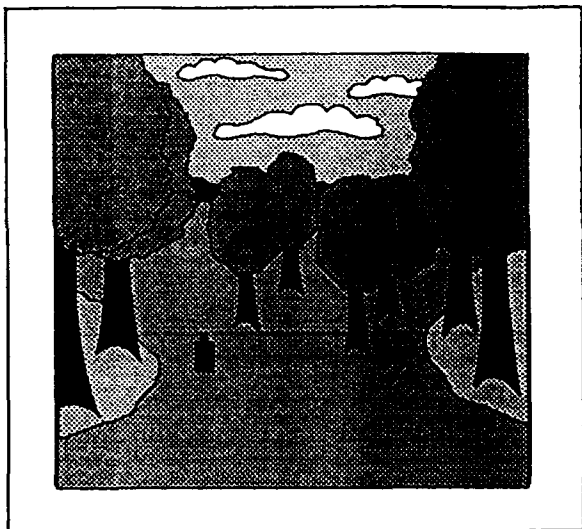
150-meter target moving at 3 mph.

4-6
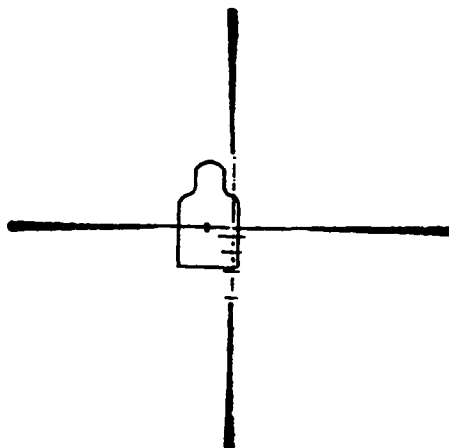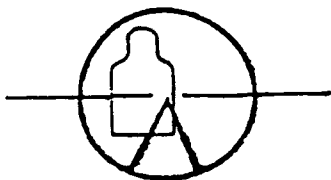
Detailed playback showing trap or track and the single lead rule as correct aiming point. While these are all close enough to show center hits when using the single lead rule, the bullets hit behind target center; 150 M -.6 cm; 200 M -1.9 cm; 250M -3.6 cm; 300 M -6 cm. Insure the aiming and shot location scores will reflect "EXCELLENT" for the above displacement. Use 5 targets at each range with the first 3 moving from left to right and the last 2 moving from right to left.

4-7

```
SUMMARY: 5 Targets -- 150 M

NUMBER OF TARGETS TRACKED -- 3
SMTH TRACK              GOOD
LEAD                    GOOD
BREATH CON                OK
TRIGGER SQ              GOOD
SHOT LOC               GOOD

NUMBER OF TARGETS TRAPPED -- 2
STEADY POS          EXCELLENT
LEAD            BELOW AVERAGE
BREATH CON                OK
TRIG PULL              GOOD
SHOT LOCATION   BELOW AVERAGE

        (Pull trigger to continue)
```
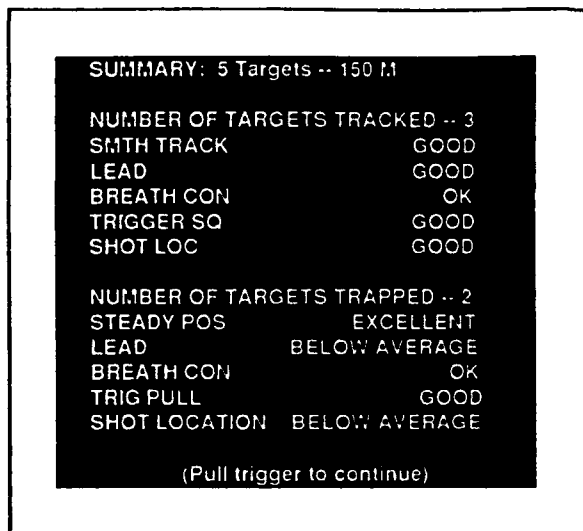
Detailed moving target review screen showing performance for targets tracked and trapped after 5 targets.

4-8

```
            150 M - 3 mph

Your 3 Shots          Your 2 Shots

      →                    ←



    Standard:  Hit 4 of 5

  (Pull trigger to continue)
```
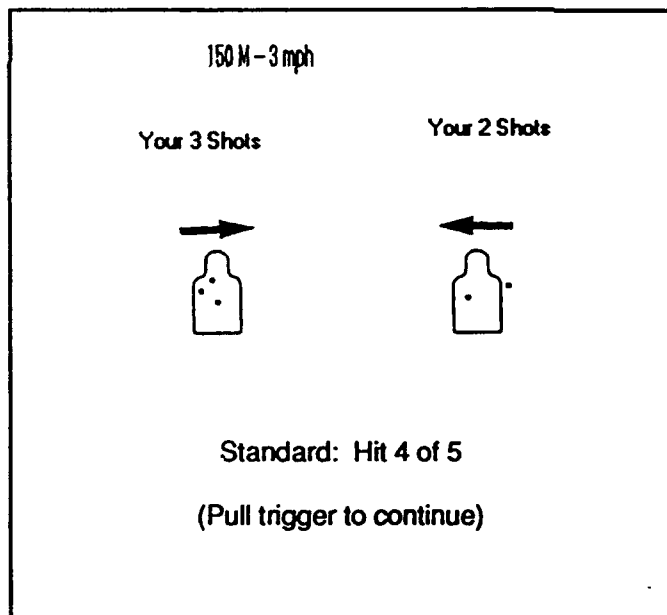
Following each range, if the standard is met, automatically move to the next range. If the standard is not met, show the following screen.

```
You did not meet
the standard.


REFIRE          ADVANCE
150 M           TO 200M
TARGETS         TARGETS

(POINT RIFLE AT CHOICE AND PULL
         TRIGGER.)
```

4-9

```
Refer to the single
lead rule as 1 lead.
More lead must be
used when distant
targets have fast
lateral speed.



(Pull trigger to continue)
```
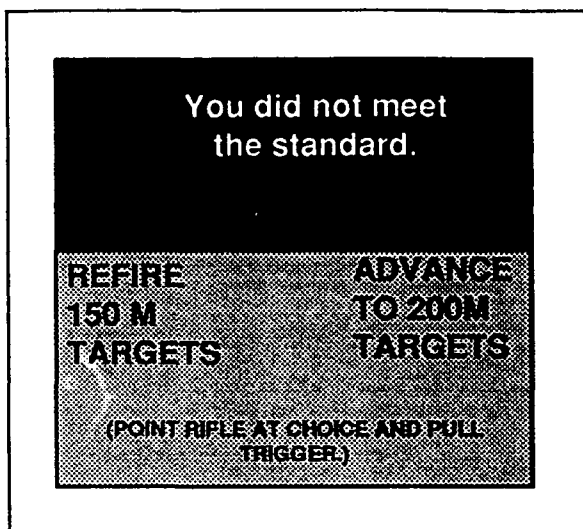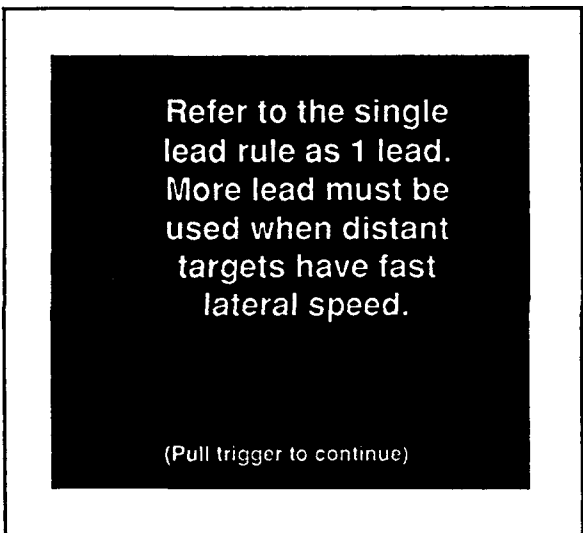
4-9a

→

For all targets less
than 150 m - 1 Lead.

For all targets at
150 m and beyond when
lateral movement is
equal to:
Walking - 1 Lead
Jogging - 2 Leads
Running - 3 Leads

(Pull trigger to continue)

4-9b

Two leads - aiming
point offset full
width of front sight post.

Three leads - aiming
point offset one and
one-half width of
front sight post.

Use 2 leads on the
following targets.

(Pull trigger to continue)

offset or (to second lead point) or (to second hash mark).

offset or (to third lead point) or (to heavy line)

4-10

Long Range Moving Target
Practice (Increased Lead)

Standard:
Hit 3 of 5 at 150 meters.
Hit 2 of 5 at 200 meters.
Hit 1 of 5 at 250 meters.
Hit 1 of 5 at 300 meters.

Pull trigger for targets

Replay can show center hits again: 150 - 1 cm behind; 200 -3.8cm behind; 250 -7.7 cm behind; 300 -3.8 cm ahead. However, this displacement should result in "EXCELLENT" aiming and shot location scores.

NOTE: This is a repeat of the single lead rule exercise. Targets at 6 mph for 150, 200, and 250 -- at 5 mph for 300.
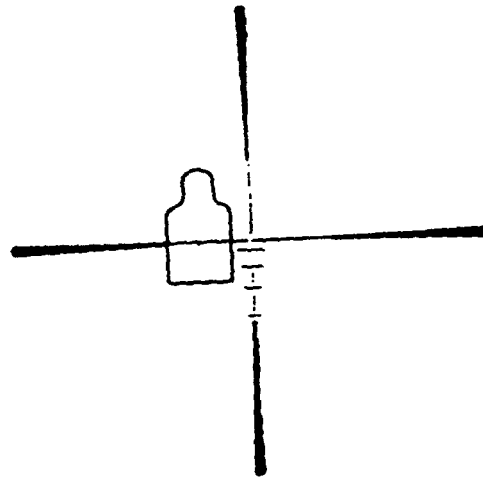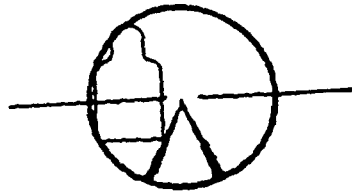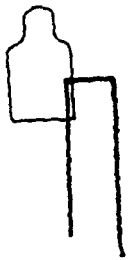
4-11

As target speed
increases, more lead
must be used. Use
three leads on
the following targets.

(Pull trigger to continue)

4-12

Long Range Moving Target
Practice (Extended Lead)

Target: Silhouette at
300 meters with a
lateral speed of 8 mph.

Standard:
Hit 1 target in 10 passes.

Pull trigger for targets

4-13
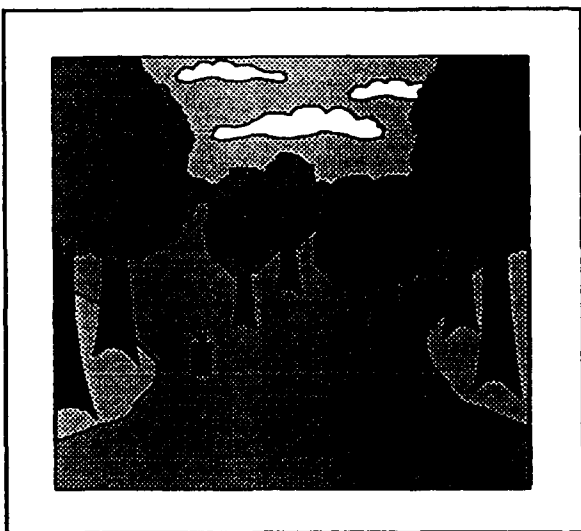
A silhouette at 300 meters moving 8 mph.

4-14

4-15

Your 10 shots at 300 meters.

→

Standard: Hit 1 of 10

(Pull trigger to continue)
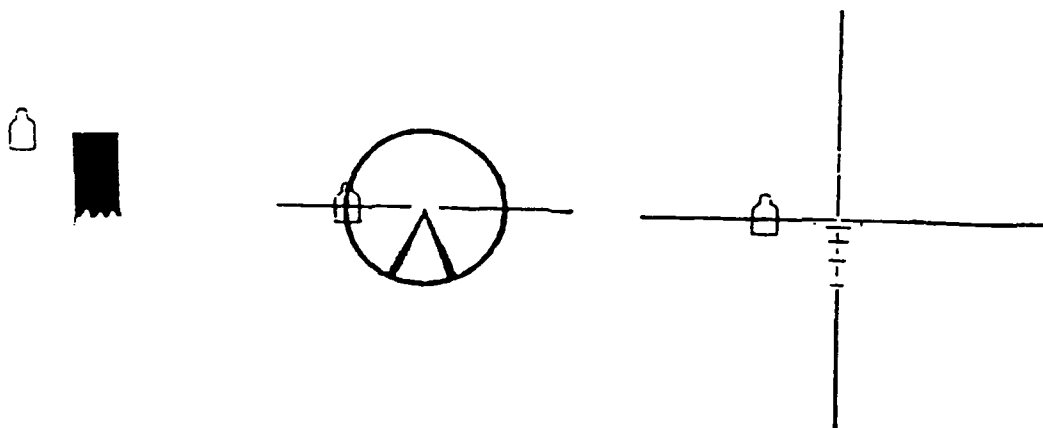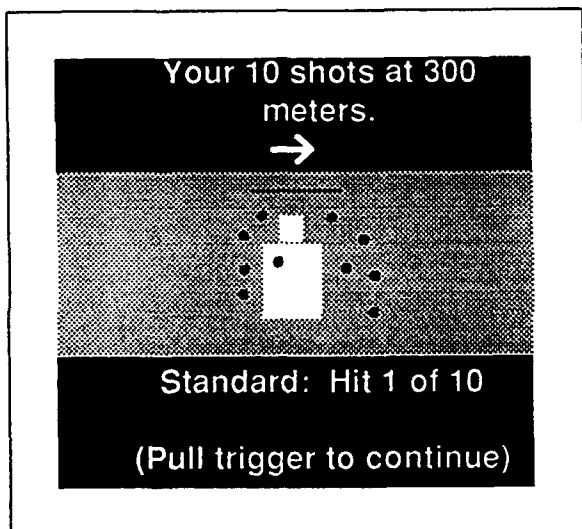
NOTE: Advance to Level 5 if standard is met.

4-16

You did not meet
the standard.

REFIRE
MOVING
TARGETS

ADVANCE
TO
LEVEL 5

(POINT RIFLE AT CHOICE AND PULL
TRIGGER.)

4-12a

Long Range Moving Target
Practice (Extended Lead)

Standard:
Given the silhouette of a
commander/driver of an
armored vehicle, *hit the*
silhouette at least 1 time
in 10 passes.

Pull trigger tfor targets
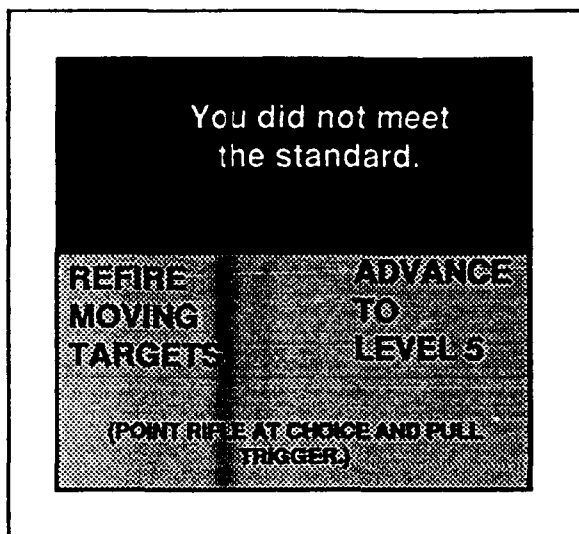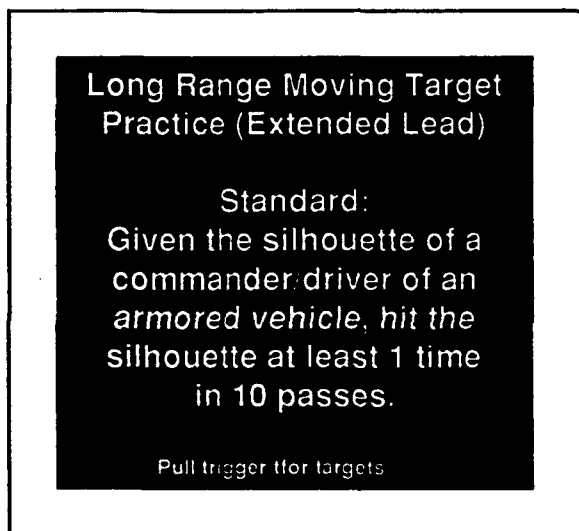
NOTE: Consider using a BRDM
type target for this
requirement, but stay with
the silhouette if the BRDM
presents a problem.

4-13a
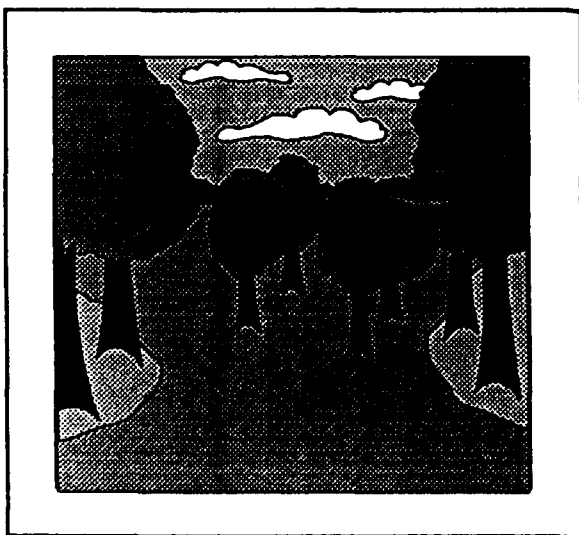
A BRDM with head and shoulders of
the commander/driver exposed, at a
distance of 300 meters, moving 8
mph.

NOTE: Use the same type of replay and
review as above.

5-1

LEVEL
5

Wind

(Pull trigger to continue)

·2

Wind has little
effect on the bullet
at short range, but
at long range, hold-
off must be used to
hit targets.

(Pull trigger for wind chart)

5-3

INCHES
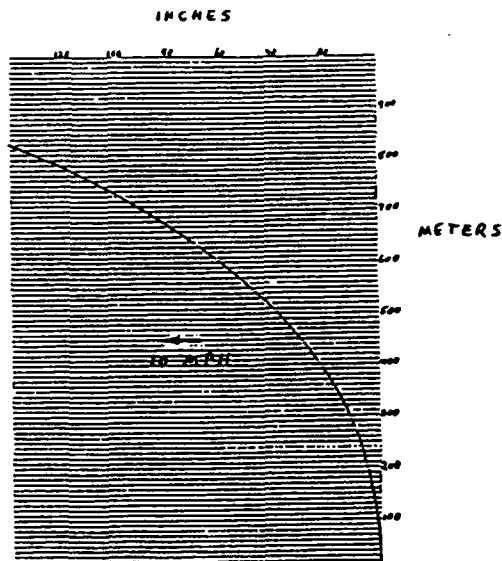
Effects of a 10 mph
full value wind

(Pull trigger to continue)

METERS

NOTE: When this chart is developed for the MACS screen, highlight:

1" - 100 m
5" - 200 m
12" - 300 m
24" - 400 m
36" - 500 m
60" - 600m

5-4

Note that effects of wind are greater at range -- moving the bullet 1 inch in the first 100 meters and over 20 inches from 500 to 600 meters.

(Pull trigger for wind chart)

-5

(Pull trigger to continue)
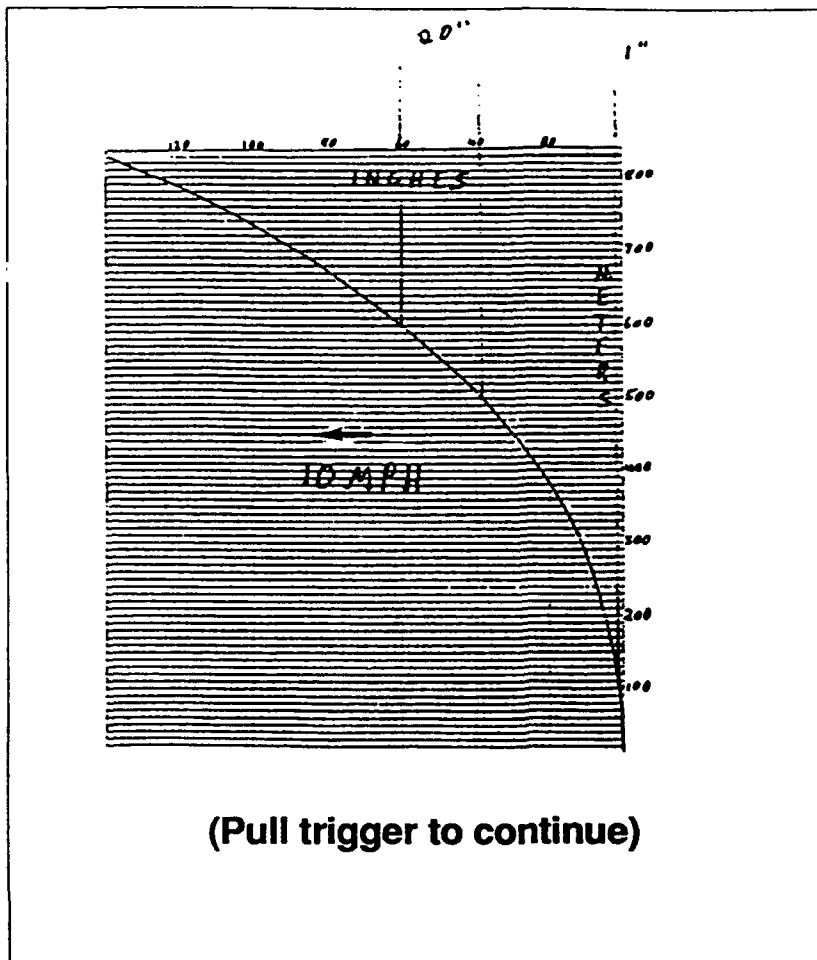
6

Note that effects of
wind are uniform in
relation to speed --
a 20 mph wind moving
the bullet twice as
much as 10, and a 5,
half as much as 10.

(Pull trigger for wind chart)

5-7

Effects of a full value 5 to 20 mph wind.
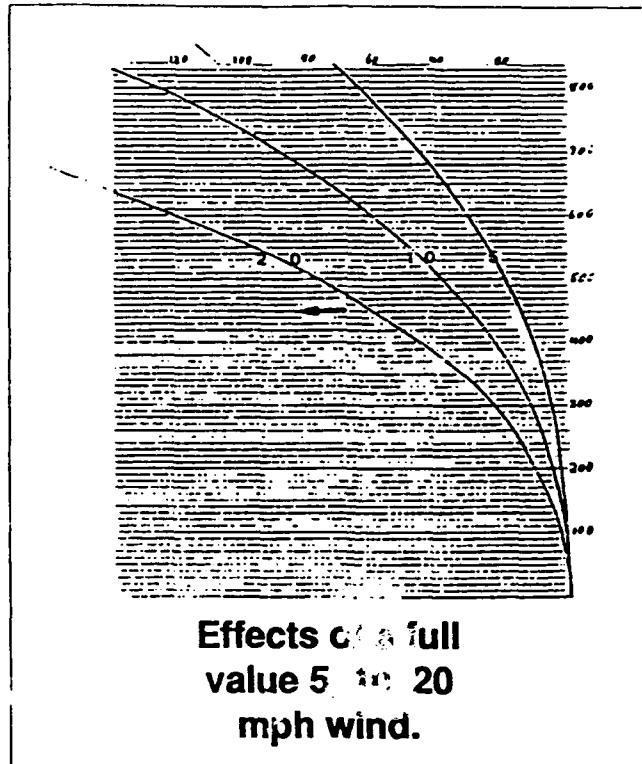
5-8

During this program wind speed will be indicated by smoke columns:

No wind:

5 mph wind:

10 mph wind:

20+ mph wind:

(Pull trigger for wind chart)
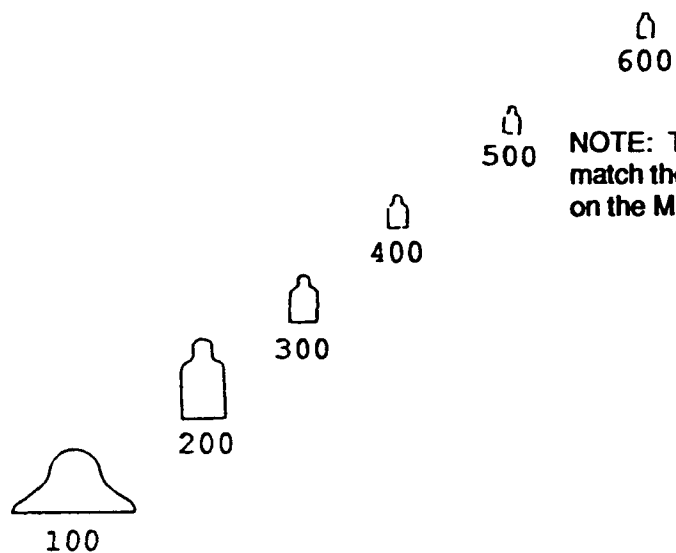
5-9

600

500 NOTE: These targets are scaled to
match the size they should appear
on the MACS screen.

400

300

200

100

Target Ranges

600

500

400

300

200

100

(Pull trigger to continue)
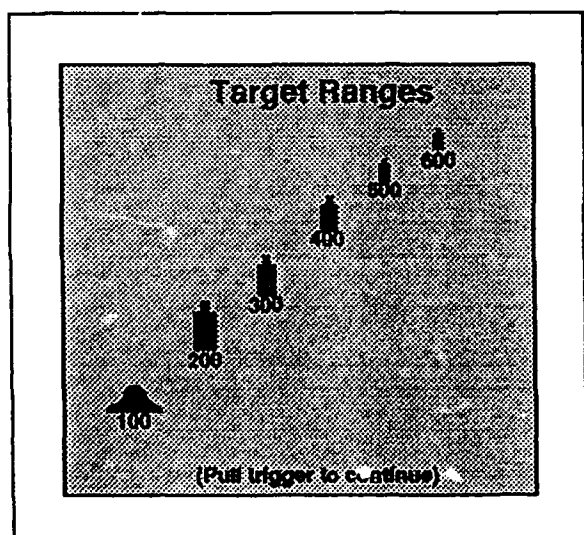
5-10

Targets are untimed.

Standard:
5 of 5 - 100 M
4 of 5 - 200 M
3 of 5 - 300 M
2 of 5 - 400 M
1 of 5 - 500 M
0 of 5 - 600 M

(Pull trigger to continue)

5-11

· Target Range: 100 Meters

· Rifle Sights Set at 300 Meters

· Wind speed shown with
  target

· Assume a supported position

Pull trigger for targets

5-12

100 M target

Wind ← 5 mph

5-13

Wind ← 5 mph

Pull Trigger for Targets
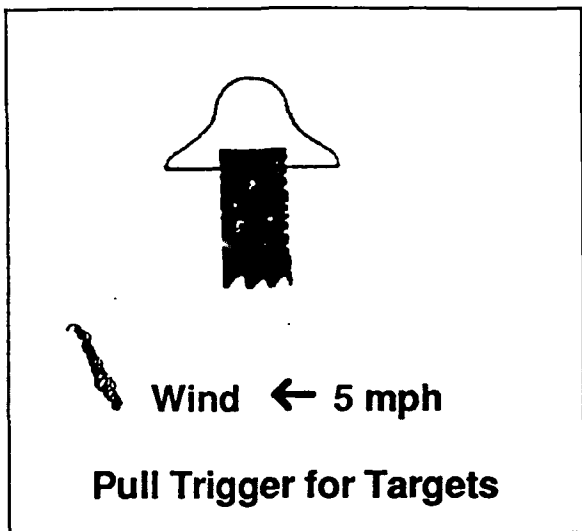
Detailed replay (aiming based on center). Bullet is 10 cm above aim point and 1.6 cm left.

NOTE: Ajust the aiming score to be correct for center, the hold-off position, or anything in a straight line beween the two.
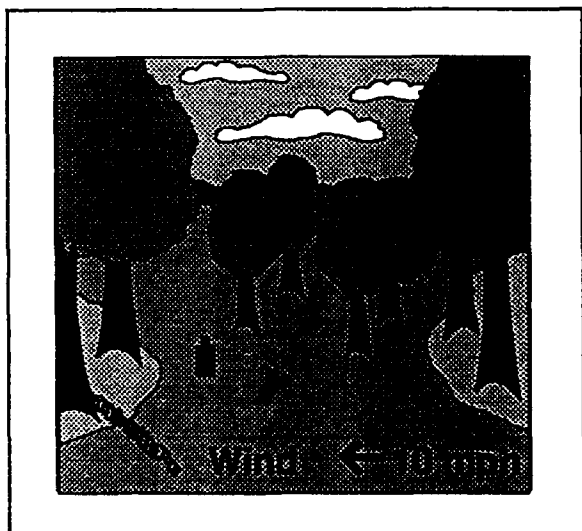
5-14

Wind ← 10 mph

100 M target.

5-15

Wind ← 10 mph

Pull Trigger for Targets
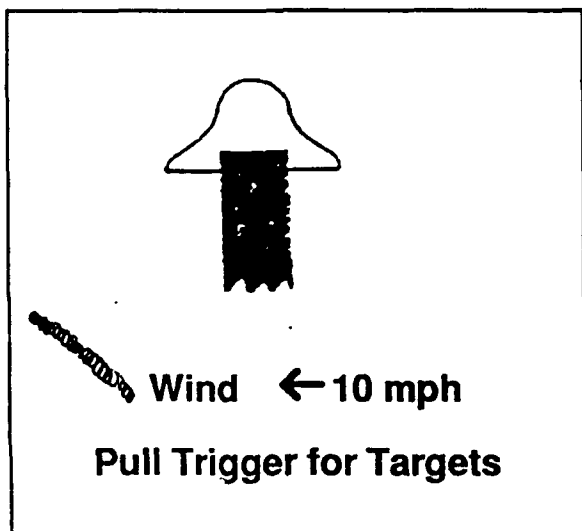
Detailed replay (aiming based on center). Bullet is 10 cm above and 3.2 cm left of aim point.

5-16

100 M target.

5-17

Wind ← 20 mph

Pull Trigger for Targets
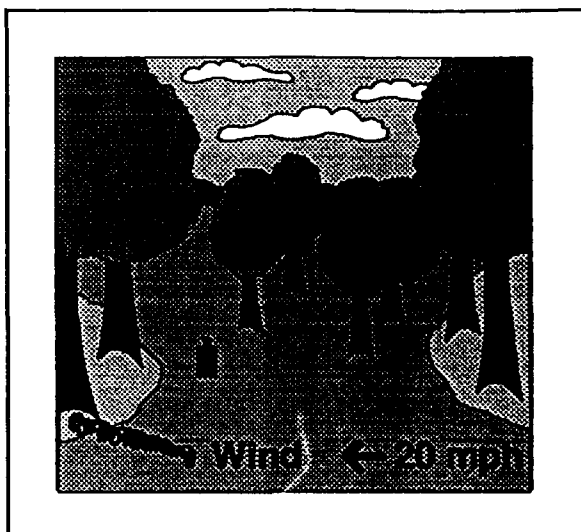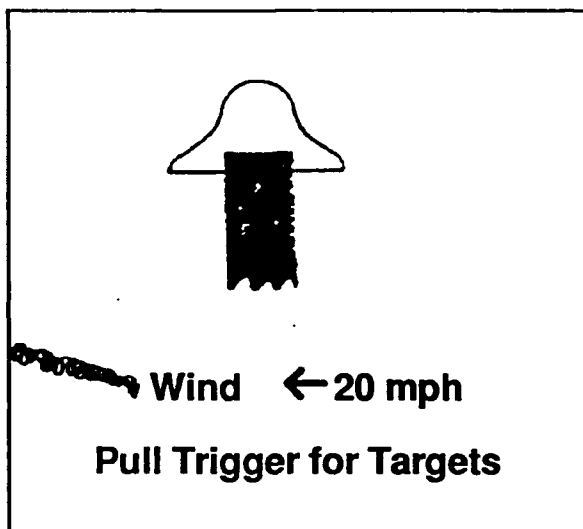
Detailed replay (aiming based on center). Bullet is 10 cm above and 3.2 cm left of aim point.

5-18

100 M target.

5-19

Wind → 20 mph

Pull Trigger for Targets
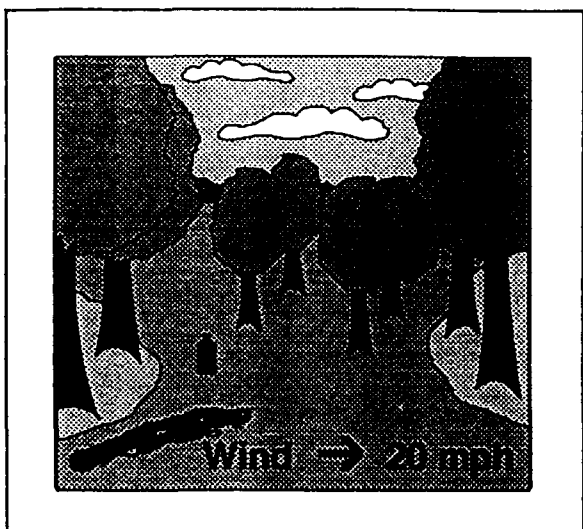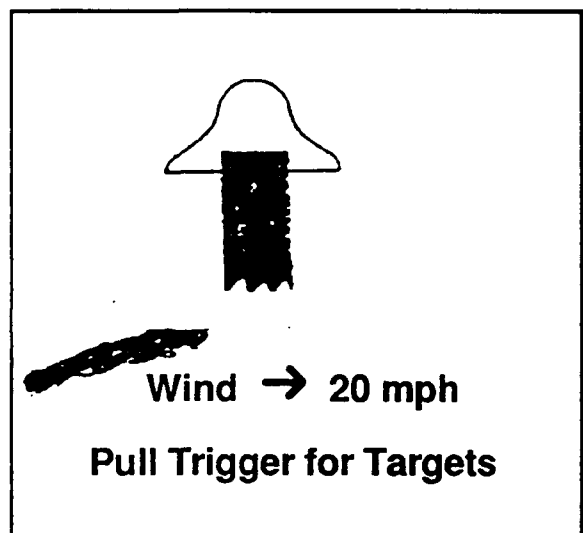
Detailed replay (aiming based on center). Bullet is 10 cm above and 6.4 cm right of aim point.

5-20

(Use 1/2 lead)
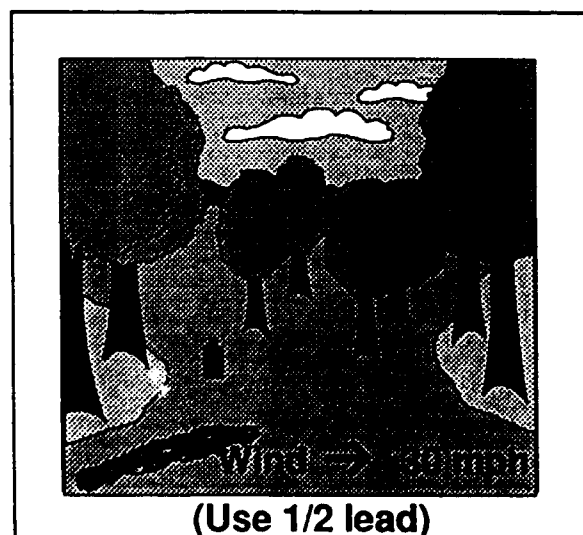
100 M target.

5-21

Detailed replay . Bullet is 10 cm
above and 9.6 cm right of aim point.
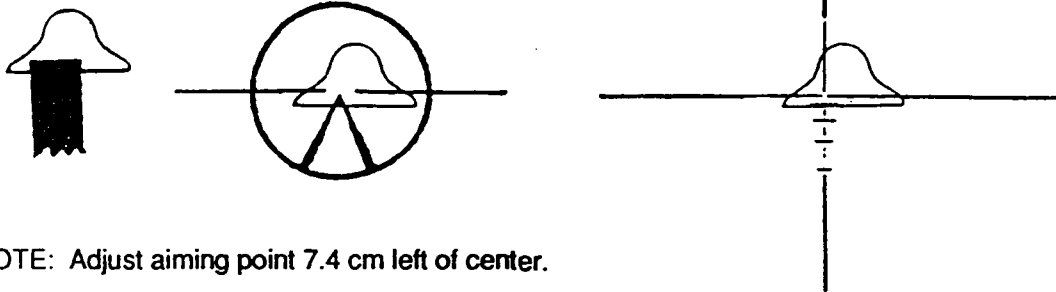
NOTE: Adjust aiming point 7.4 cm left of center.

5-22

Target with 5 shot locations.

Your 5 shots at 100 meters

← 5 MPH
← 10 MPH
← 20 MPH
20 MPH →
30 MPH →
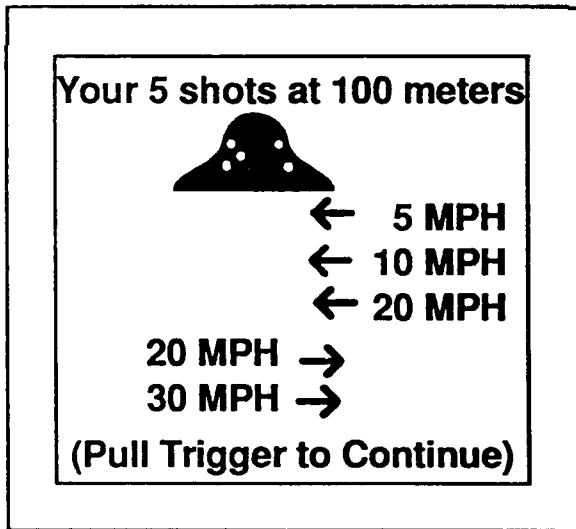
(Pull Trigger to Continue)

NOTE: In sequence, flash the bullet and
the corresponding arrow for each shot.

5-23

As you can see,
hold-off for wind at
ranges of 100 meters
or less is seldom
required.

(Pull Trigger to Continue)

5-24

As a memory aid, try
to remember the
effects of a 10 mph
wind - 1, 5, 1, 2, 3, 5:
100 M - 1 inch
200 M - 5 inches
300 M - 1 foot
400 M - 2 feet
500 M - 3 feet
600 M - 5 feet
(Pull Trigger to Continue)

5-25

· Target Range: 200 Meters

· Rifle Sights Set at 300 Meters

· Wind speed shown with
 target

· Assume a supported position

Pull trigger for targets

5-26

200 M target

5-27

Wind ← 5 mph

Pull Trigger for Targets
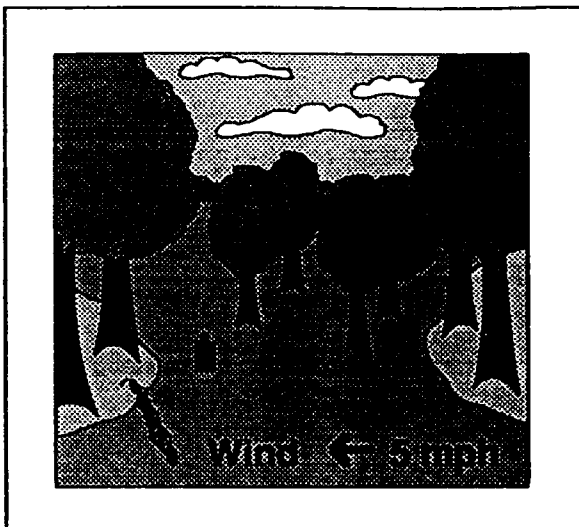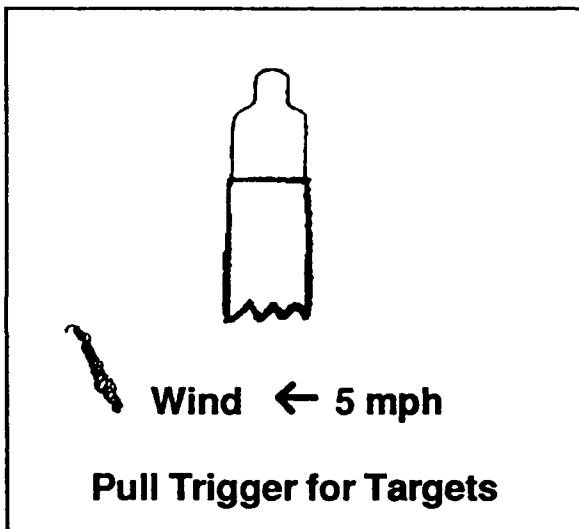
Detailed replay. Center aiming..
Bullet is 14 cm above and 6 cm left
of aim point.

5-28

(Use 1/2 lead)

200 M target.

-29

Wind ← 10 mph

Pull Trigger for Targets
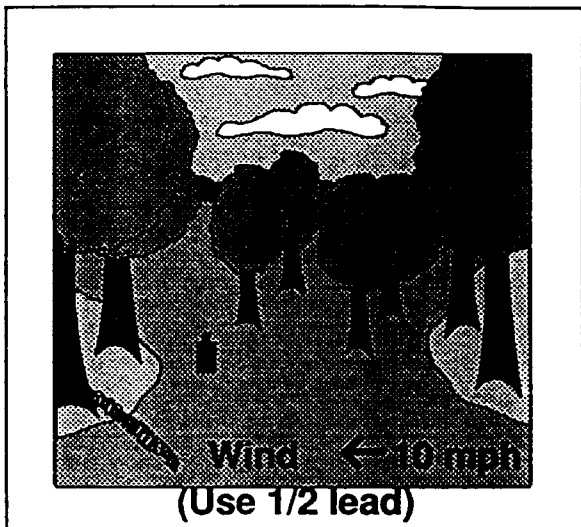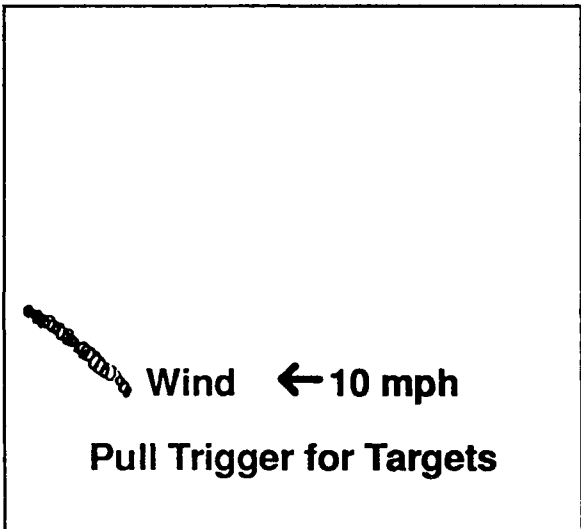
Playback. Bullet 14 cm above and 13 cm left of aim point. Displace aim point 15 cm right.

5-30

(Use single lead rule)

200 M target.

5-31

Wi_Ad ←20 mph

Pull Trigger for Targets
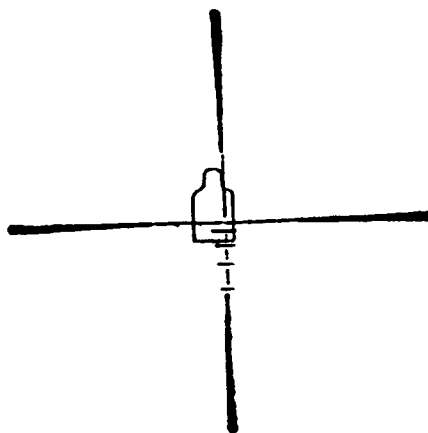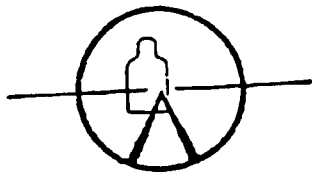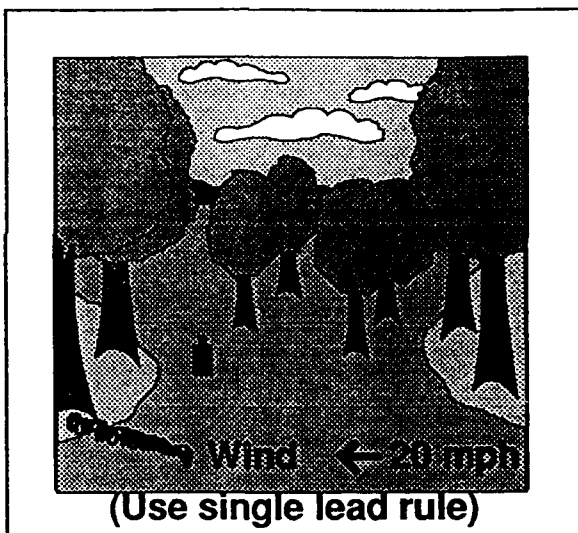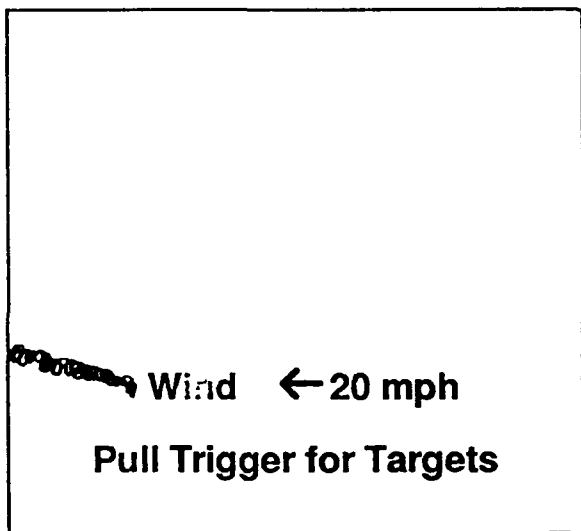
Playback. Displace aim point 29 cm right. Bullet hits 14 cm above and 26 cm left of aim point.

5-32

Wind → 20 mph

200 M target.

5-33

Wind → 20 mph

Pull Trigger for Targets
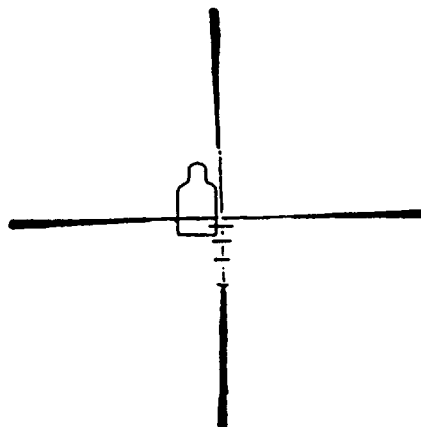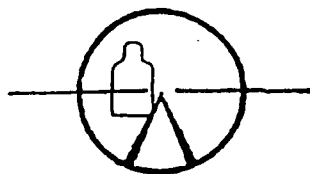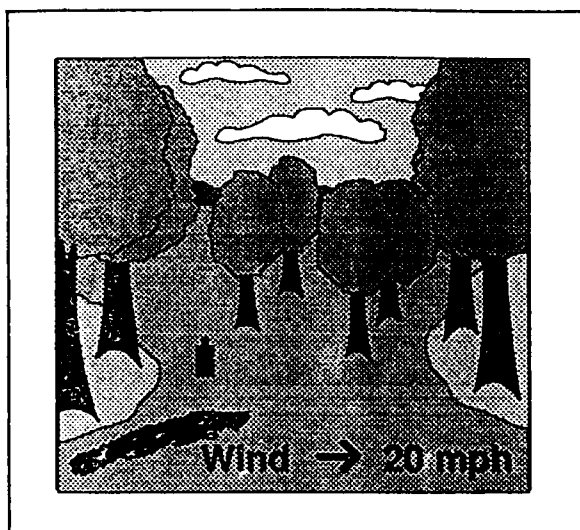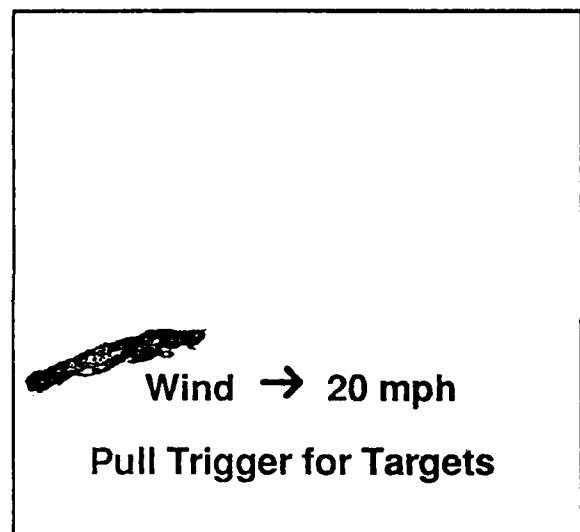
Playback. Reverse of 5-31. Displace aim point 29 cm left. Bullet hits 14 cm above and 26 cm right of aim point.

5-34

200 M target.

5-35

No value wind ⬆ 30 mph
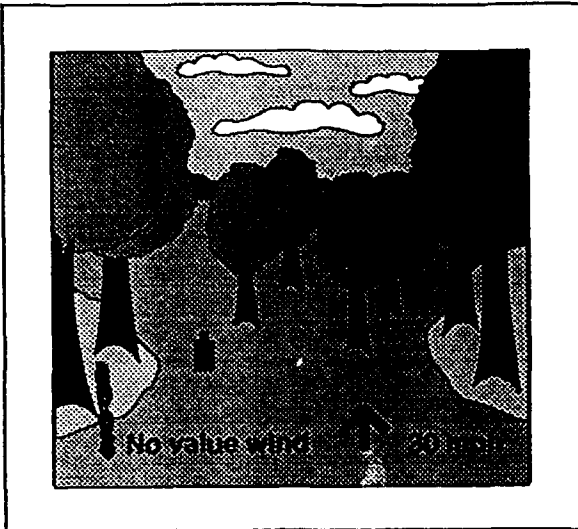
Pull Trigger for Targets
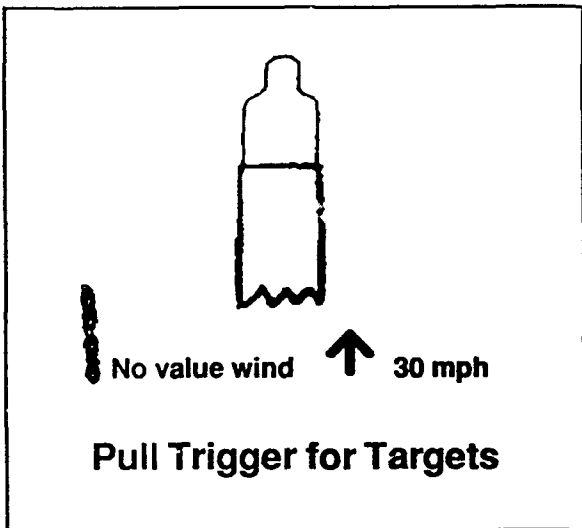
Playback. Center aim. Bullet hits 14 cm above aim point.

5-36

Remember that a head wind ⬆ and a tail wind ⬇ have no effect on the bullet. A 45 degree wind ⬈ has half value – use 10 mph aim for 20 mph wind.

(Pull Trigger to Continue)
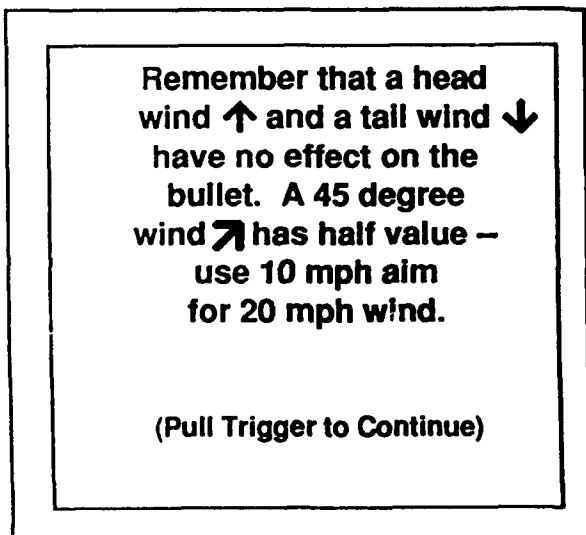
MAKE 45 DEGREE ARROWS TO GO IN HERE.

-36a

As you review your
200 M shots, remember
the 10 mph memory aid:

1, 5, 1, 2, 3, 5

10 mph wind = 5 "
5 mph wind = 2-1/2"
20 mph wind = 10 "

(Pull Trigger to Continue)

5-37

Your 5 shots at 200 meters

→ 5 MPH
→ 10 MPH
→ 20 MPH
20 MPH ←
↑ 30 MPH

(Pull Trigger to Continue)

Target with 5 shot locations.

Showing the 5 shot locations, each bullet
and corresponding arrow blink -- in
sequence.

5-38

· Target Range: 300 Meters

· Rifle Sights Set at 300 Meters

· Wind speed shown with
 target

· Assume a supported position

Pull trigger for targets

5-39

300 M target.

5-40

Wind ← 5 mph

Pull Trigger for Targets
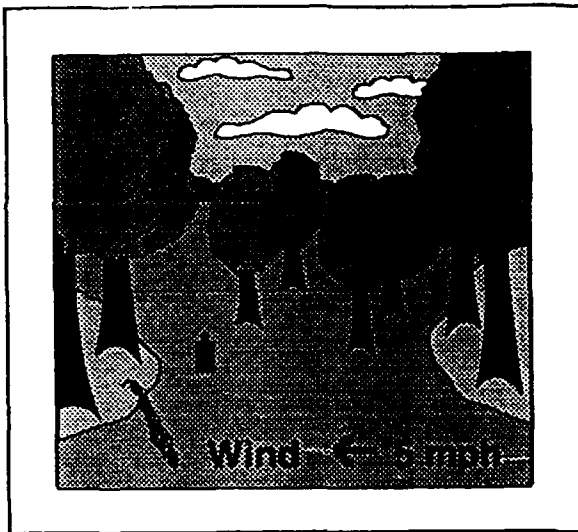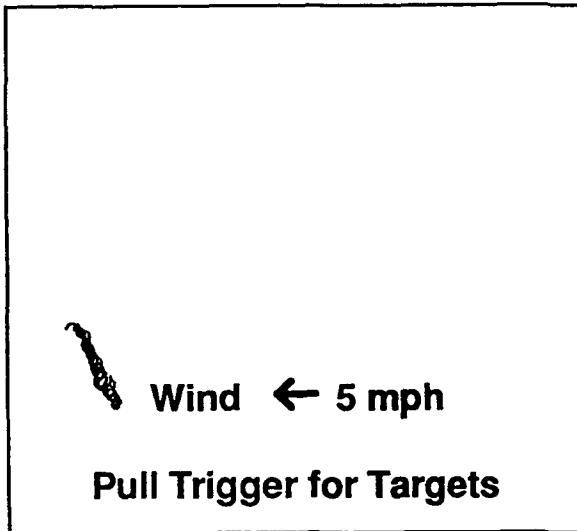
Playback. Displace aim point half way between target center and target edge. Bullet hits 15 cm left of aim point, 2 cm left of center.

5-41

(Aim at target edge)

300 M target.

5-42

Wind ← 10 mph

Pull Trigger for Targets
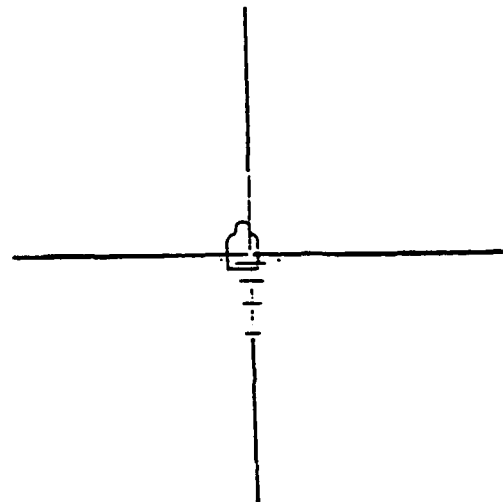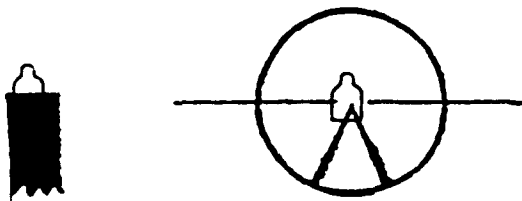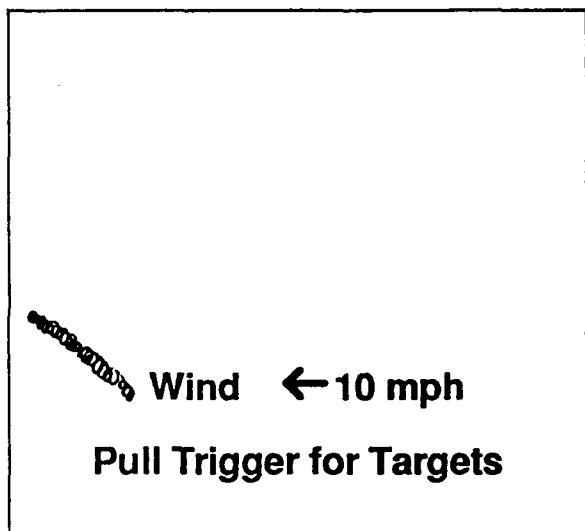
Playback. Displace aim point 25 cm right. Bullet hits 29 cm left of aim.

5-43

(Use single lead rule)

300 M target.

5-44

Wind ← 20 mph

Pull Trigger for Targets
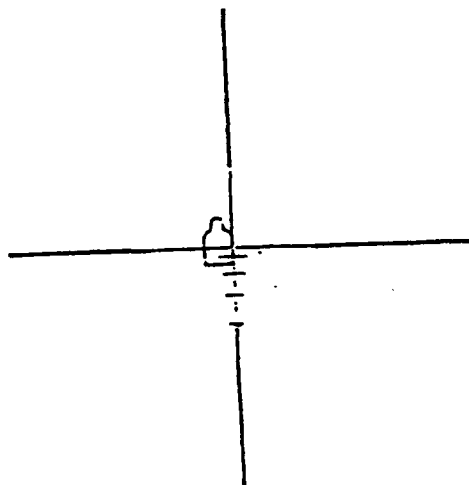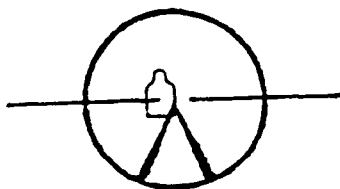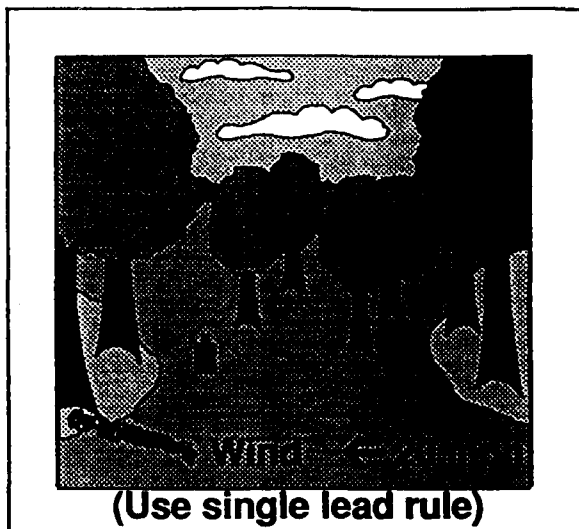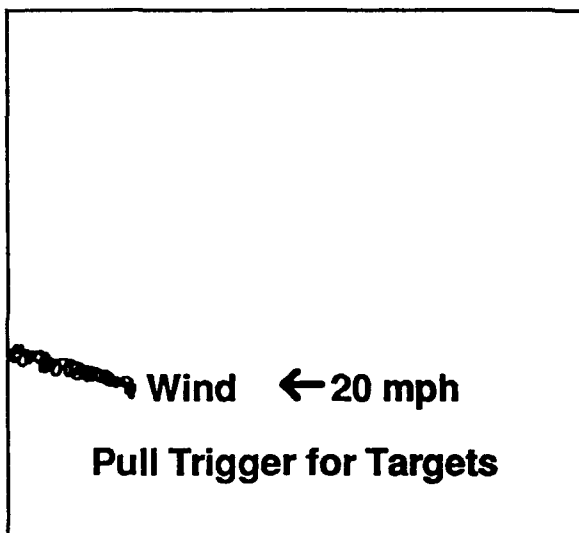
Playback. Displace sight 45 cm right. Bullet hits 58 cm left of aim.
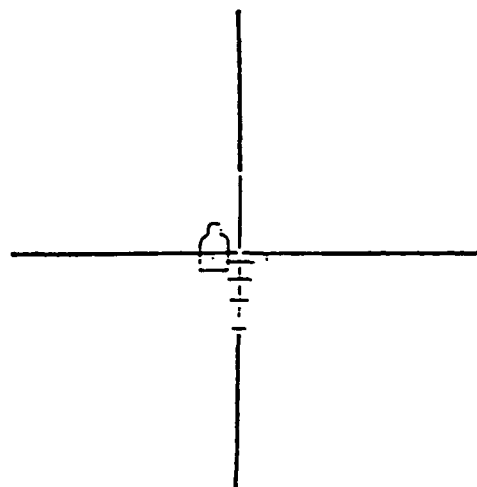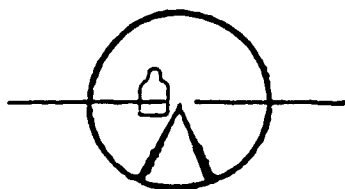
5-45
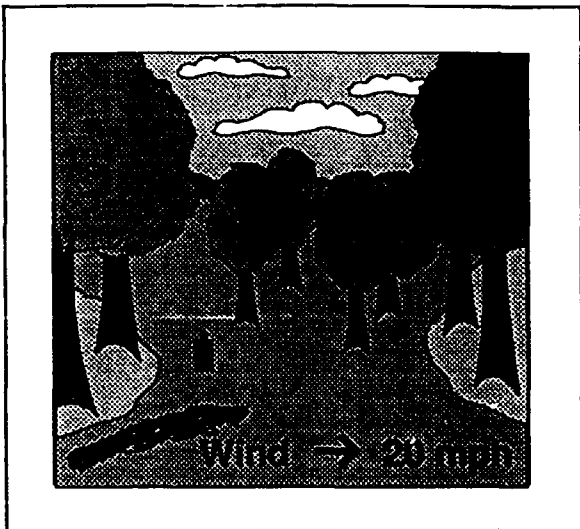
300 M target.

5-46
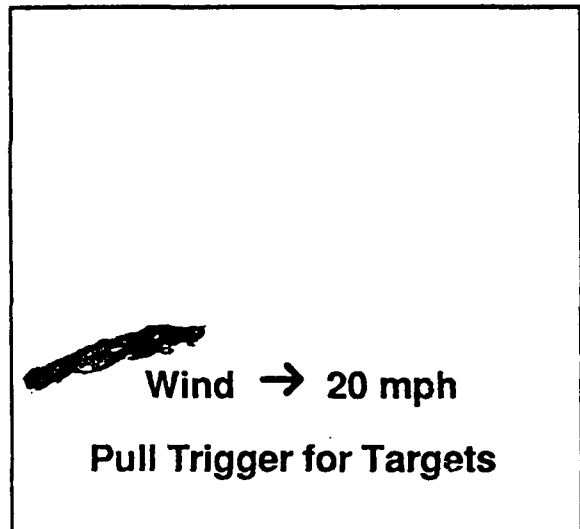
Playback. Displace sight left 45 cm. Bullet hits 58 cm right of aim. (Reverse of 5-44.)

Wind → 20 mph

Pull Trigger for Targets

5-47

300 M target.

5-48

Wind → 15 mph
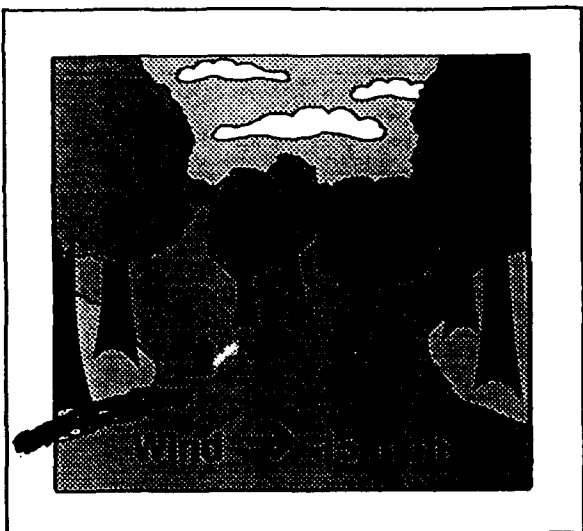
Pull Trigger for Targets
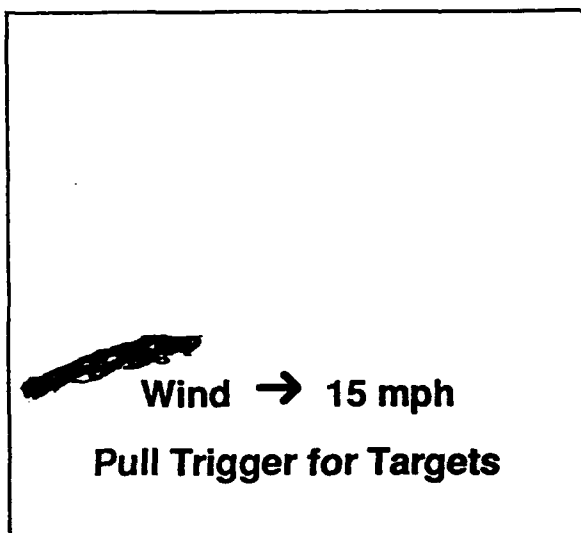
Playback. Single lead rule hits target center.

5-48a

The 10 mph rule:

300 M = 1 foot
5 mph = 6 "
10 mph = 12 "
15 mph = 18"
20 mph = 24 "

(Pull trigger to continue)

5-49

Your 5 shots at 300 meters

→ 5 MPH
→ 10 MPH
→ 20 MPH
← 20 MPH
← 15 MPH

(Pull Trigger to Continue)

5-shot replay.

5-50

· Target Range: 400 Meters

· Rifle Sights Set at 400 Meters

· Wind speed shown with
  target

· Assume a supported position

Pull trigger for targets

5-51

(Aim at target edge)

400 M target.

5-52

Wind → 5 mph
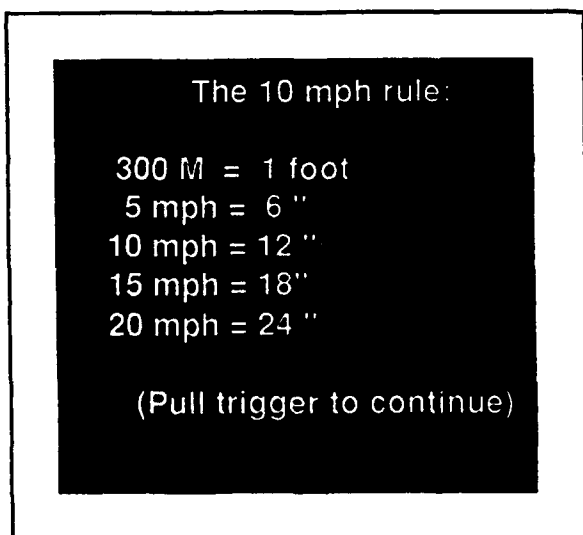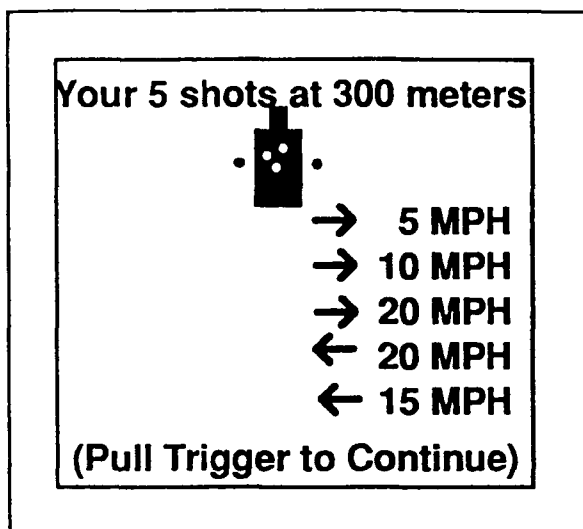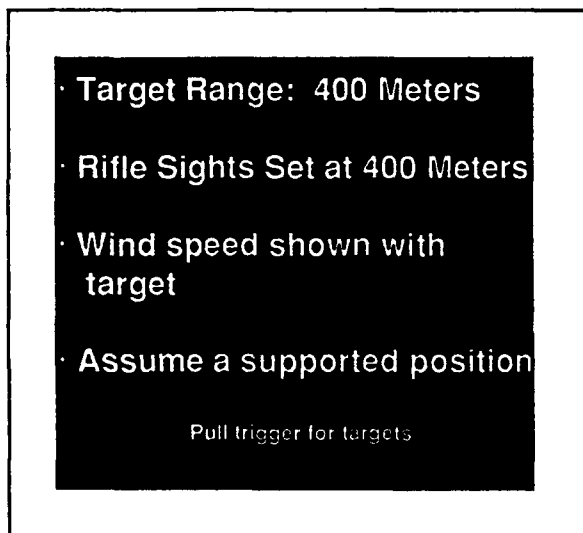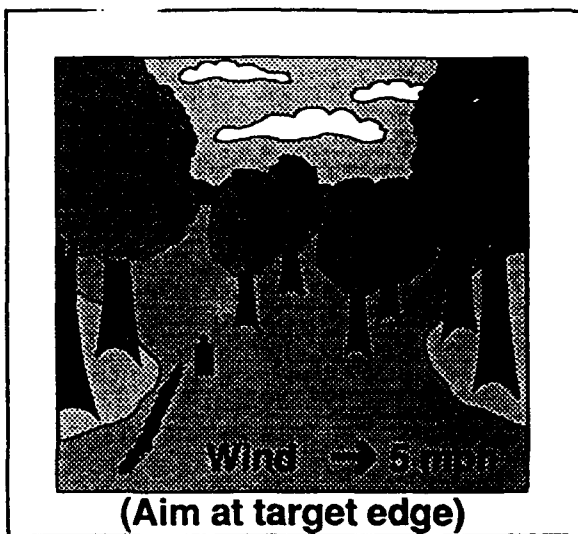
Pull Trigger for Targets
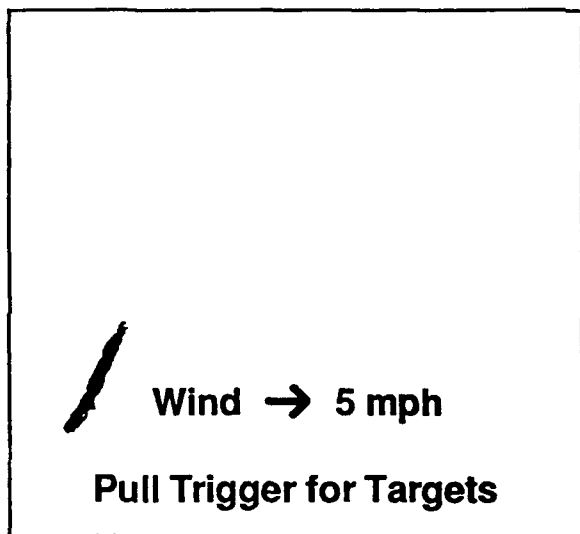
Playback. Displace sight 29 cm left. Bullet hits 29 cm right of aim.

5-53

400 M target.

(Use single lead rule)

5-54

Playback. Displace sight 59 cm left.
Bullet hits 58 cm right of aim.

Wind → 10 mph

Pull Trigger for Targets

5-55

400 M target.

(Use 2 leads)

5-56

Playback. Displace sight 118 cm left. Bullet hits 116 cm right of aim.
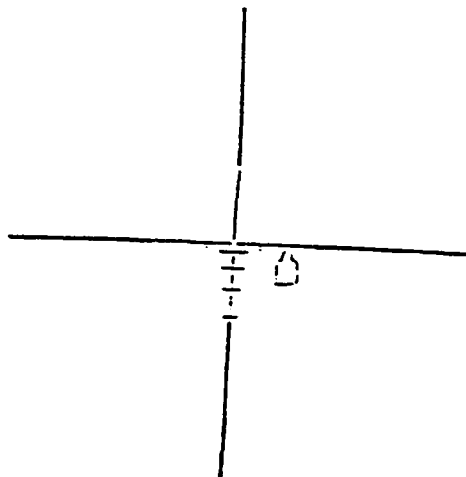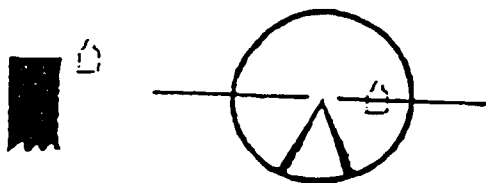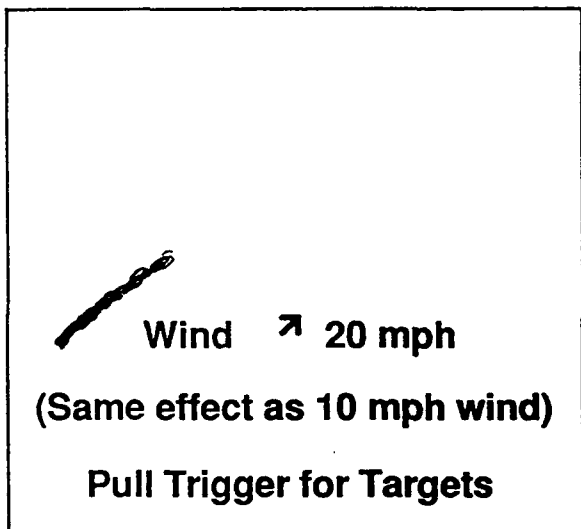
Wind → 20 mph

Pull Trigger for Targets

-57

400 M target.

(Use single lead rule)

·58

Playback. Displace sight 59 cm
left. Bullet hits 58 cm right of aim.

Wind ↗ 20 mph

(Same effect as 10 mph wind)

Pull Trigger for Targets

5-59

(Use single lead rule)

400 M target.

5-60

Wind ← 10 mph
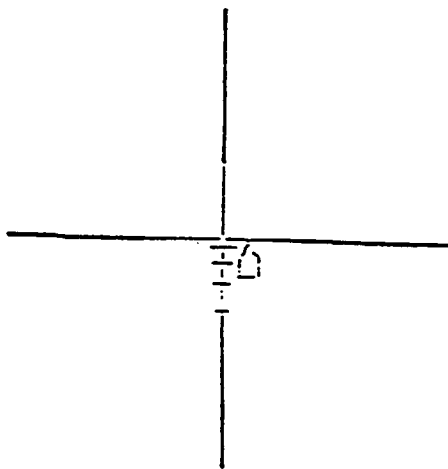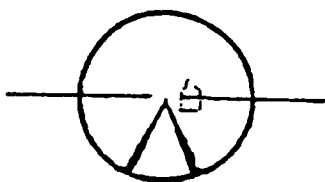
Pull Trigger for Targets
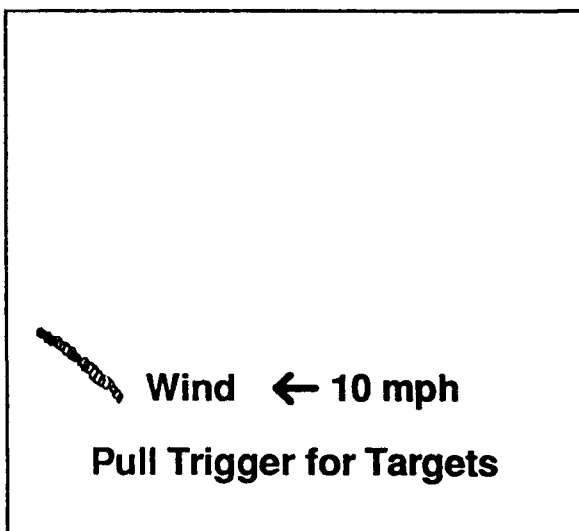
Playback. Displace sight 59 cm right. Bullet hits 58 cm left of aim.
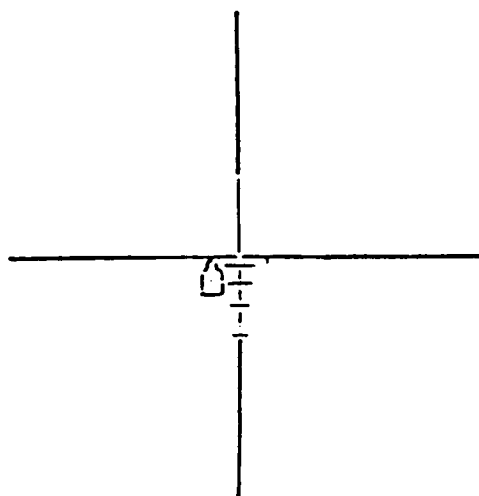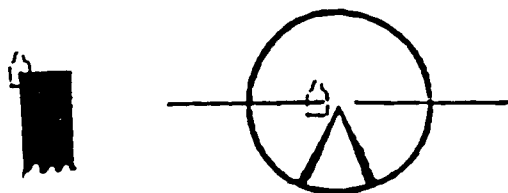
5-60a

The 10 mph wind rule:

1, 5, 1, 2, 3, 5

400 M = 2 feet

5 mph = 12"
10 mph = 24"
20 mph = 48"

Assume targets are
15-20" wide.

(Pull Trigger to Continue)

5-61

Your 5 shots at 400 meters

→ 5 MPH
→ 10 MPH
→ 20 MPH
↗ 20 MPH
← 10 MPH

(Pull Trigger to Continue)

Target with 5 shot locations.

Showing the 5 shot locations, each bullet and corresponding arrow blink -- in sequence.

5-62

· Target Range: 500 Meters

· Rifle Sights Set at 500 Meters

· Wind speed shown with target

· Assume a supported position

Pull trigger for targets

5-63

500 M target.

5-64

Wind ← 5 mph

Pull Trigger for Targets
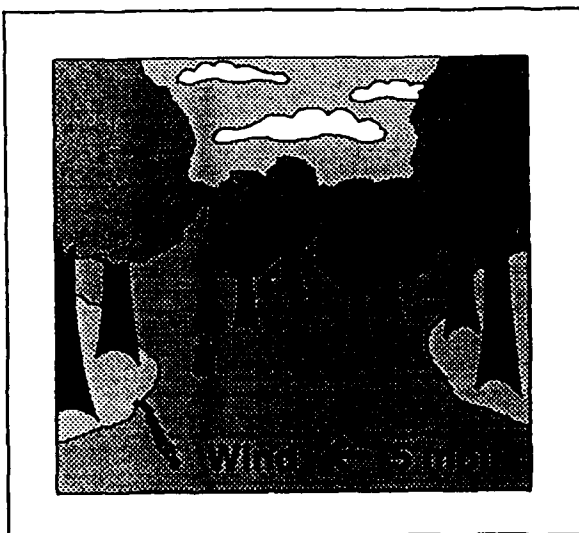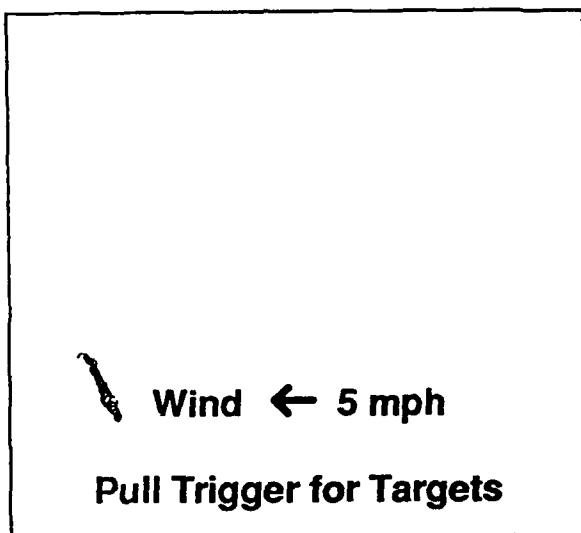
Playback. Displace sight 37 cm right. Bullet hits 48 cm left of aim.
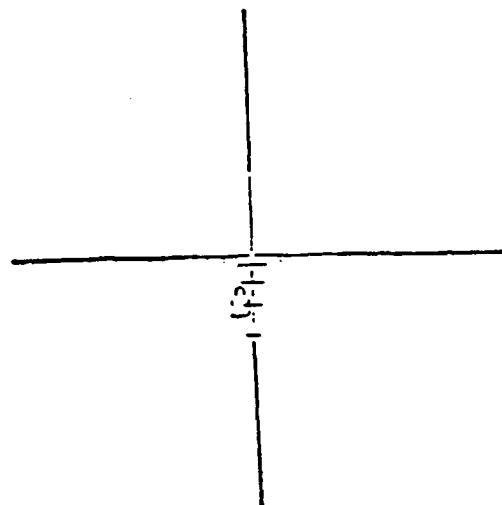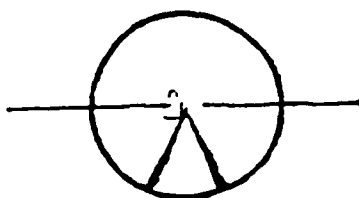
5-65
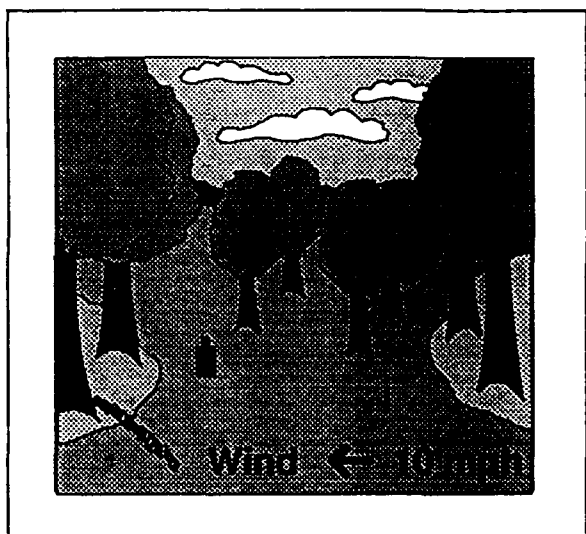
500 M target.

5-66
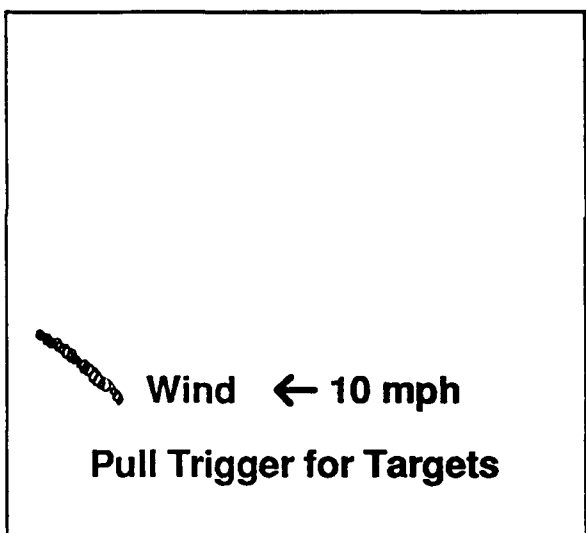
Playback. Displace sight 98 cm right. Bullet hits 97 cm left of aim.

Wind ← 10 mph

Pull Trigger for Targets

5-67

500 M target.

5-68

Wind ← 20 mph

Pull Trigger for Targets
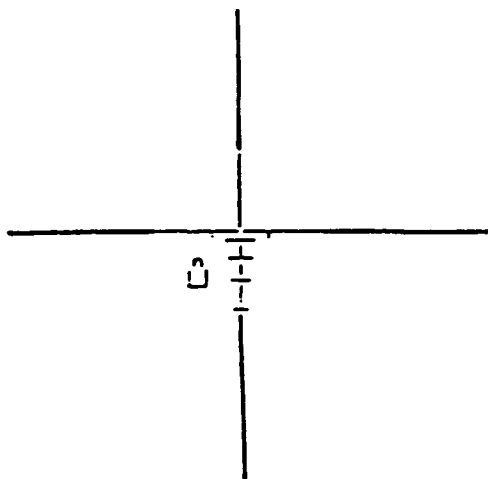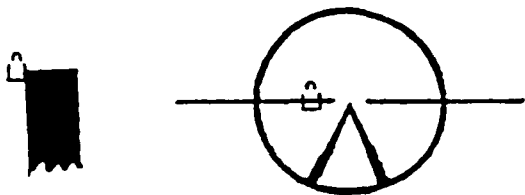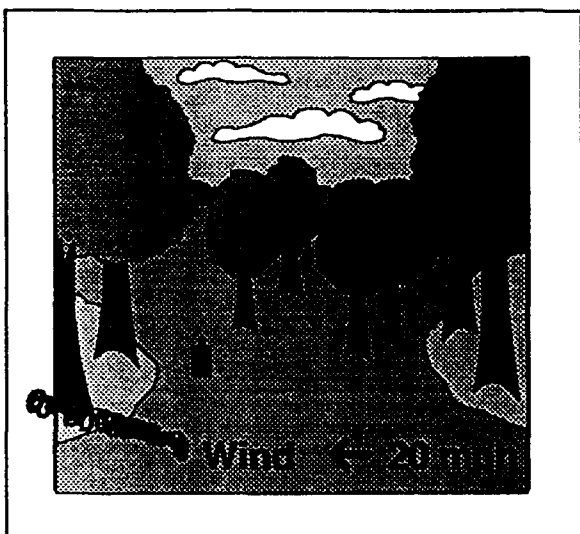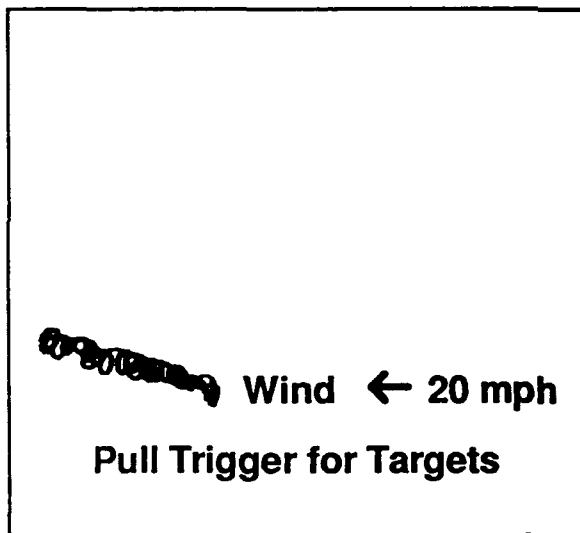
Playback. Displace sight 195 cm right. Bullet hits 193 cm left of aim.

5-69

500 M target.

5-70

Wind → 8 mph

Pull Trigger for Targets
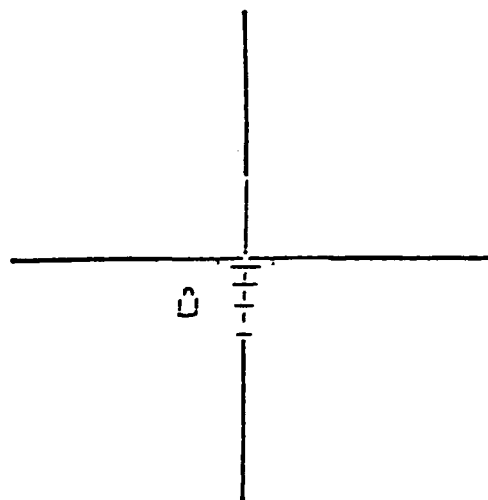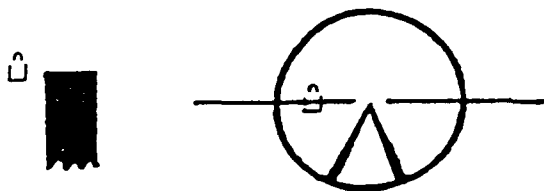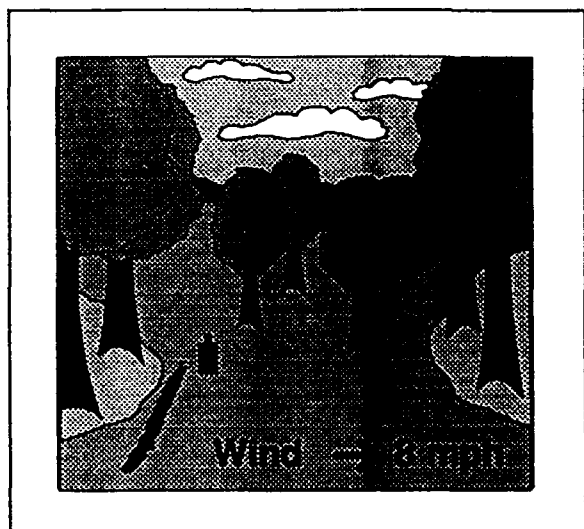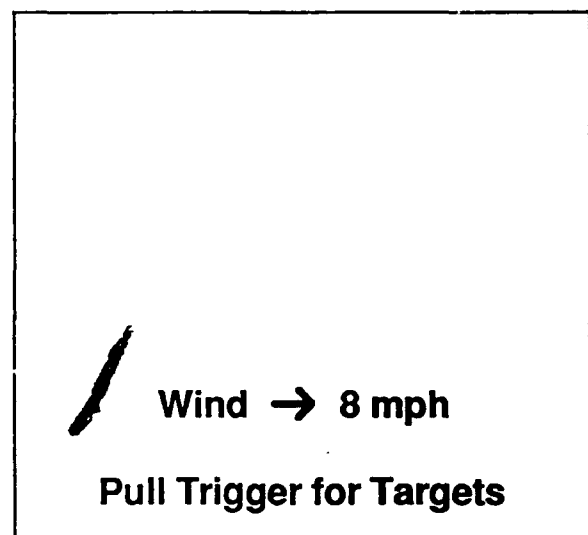
Playback. Displace sight 74 cm left. Bullet hits 77 cm right of aim.

5-71

500 M target.

5-72

Wind ⬋ **16 mph (8 mph)**

Pull Trigger for Targets
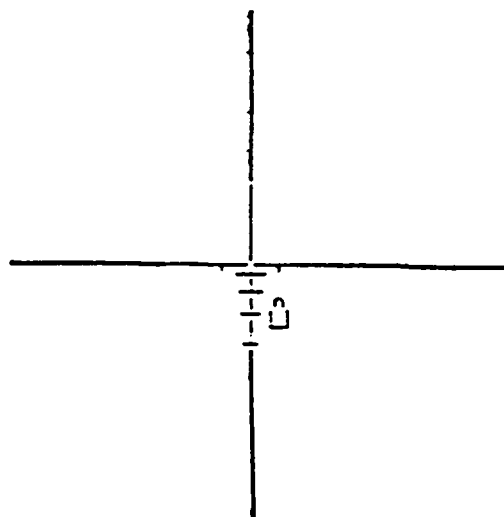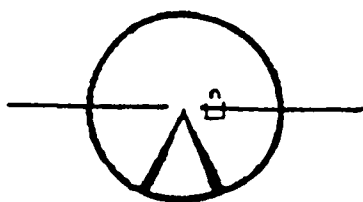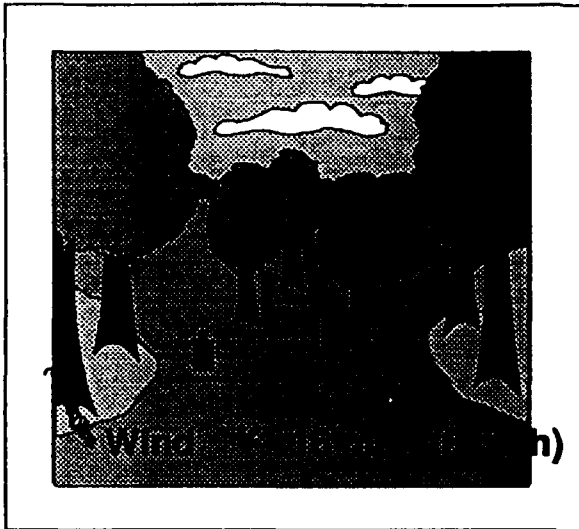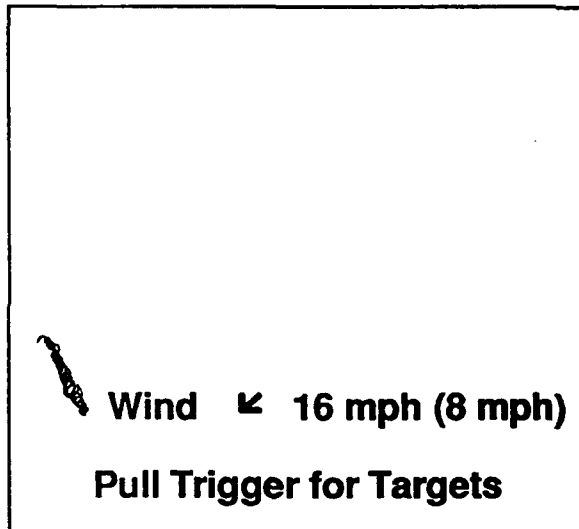
Playback. Reverse of 5-70.

5-60a
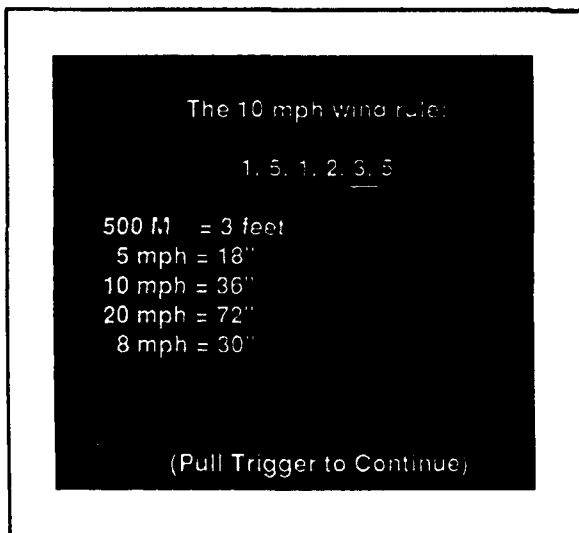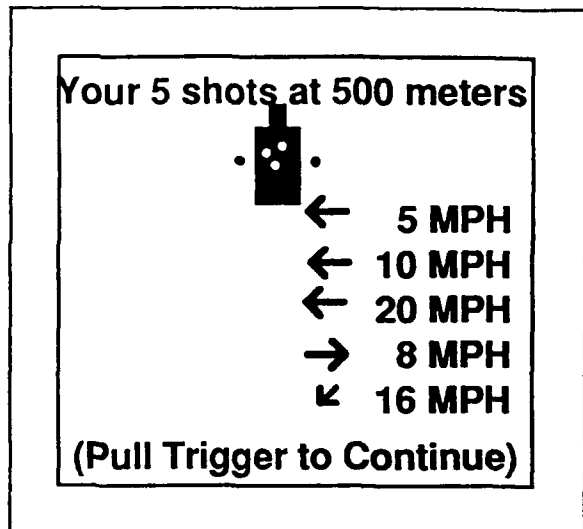
The 10 mph wind rule:

1. 5. 1. 2. 3. 5

500 M = 3 feet
5 mph = 18"
10 mph = 36"
20 mph = 72"
8 mph = 30"

(Pull Trigger to Continue)

5-73

> **Your 5 shots at 500 meters**
>
> ← 5 MPH
> ← 10 MPH
> ← 20 MPH
> → 8 MPH
> ↙ 16 MPH
>
> **(Pull Trigger to Continue)**

Target with 5 shot locations.

Showing the 5 shot locations, each bullet and corresponding arrow blink -- in sequence.

5-74

> · Target Range: 600 Meters
>
> · Rifle Sights Set at 600 Meters
>
> · Wind speed shown with target
>
> · Assume a supported position
>
> Pull trigger for targets

5-75

600 M target.

5-76

Wind → 5 mph

Pull Trigger for Targets
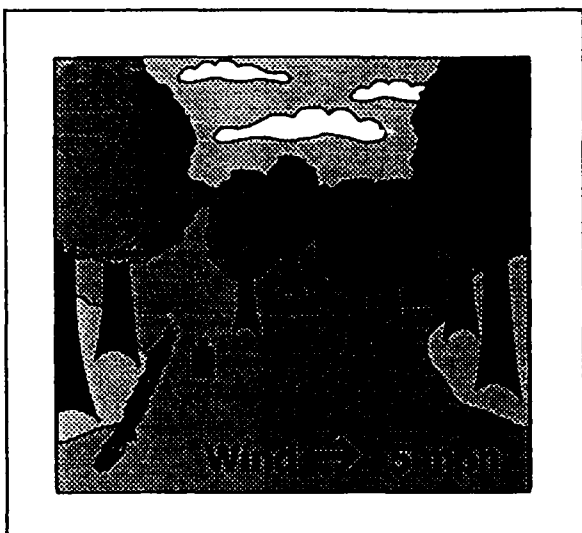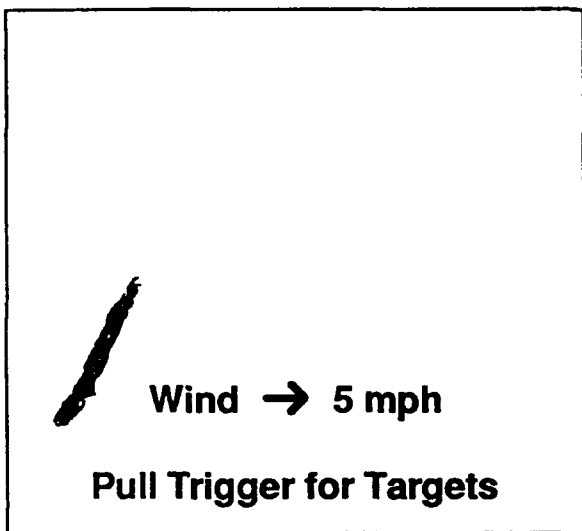
Playback. Displace sight 77 cm left. Bullet hits 77 cm right of aim.

5-77

600 M target.

5-78

Wind → 10 mph

Pull Trigger for Targets
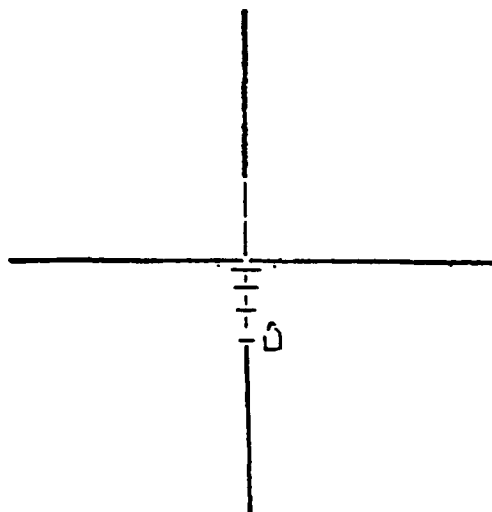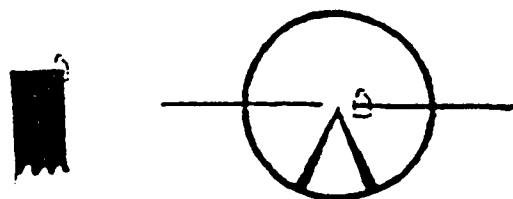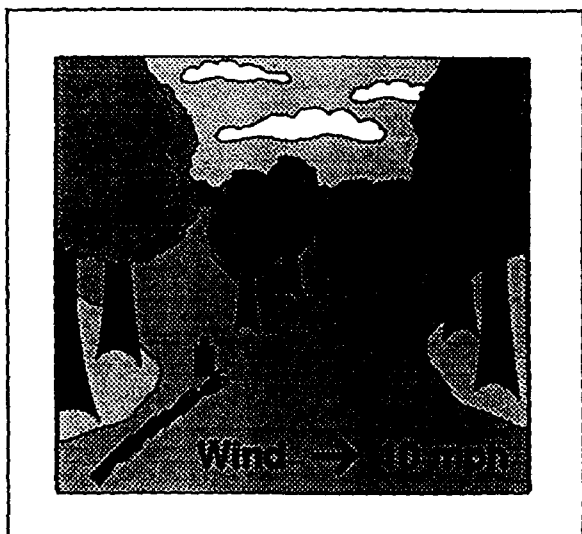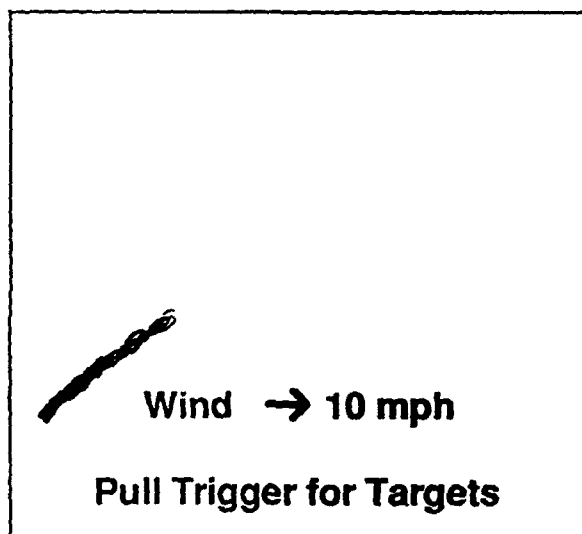
Playback. Displace sight 155 cm
left. Bullet hits 155 cm right of aim.

5-79

(Use 3 leads)

600 M target.

5-80

Wind → 20 mph

Pull Trigger for Targets
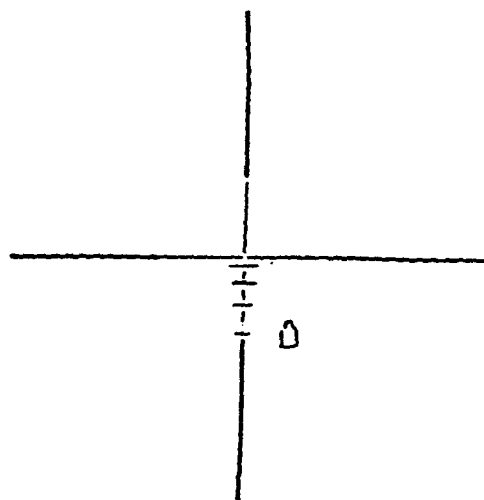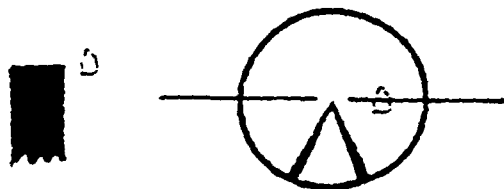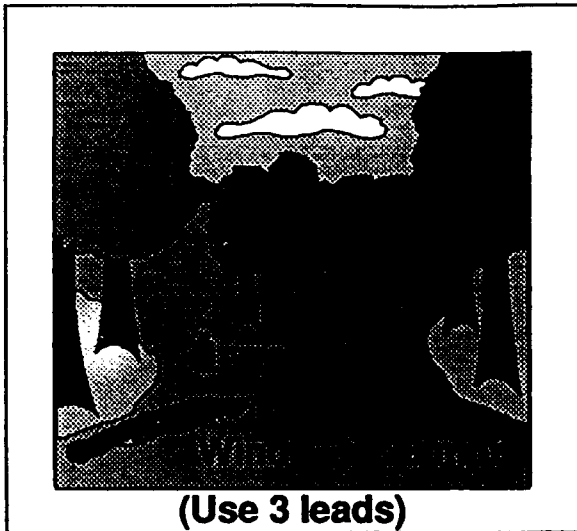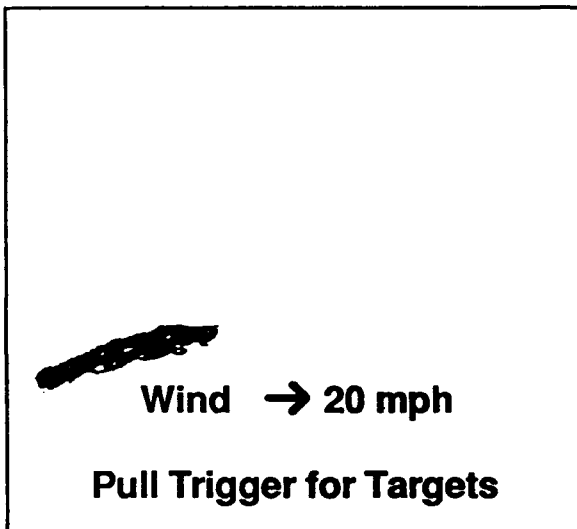
Playback. Displace sight 309 cm left. Bullet hits 309 cm right of aim.

5-81

(Use single lead rule)

600 M target.

5-82

Wind ← 6 mph

Pull Trigger for Targets
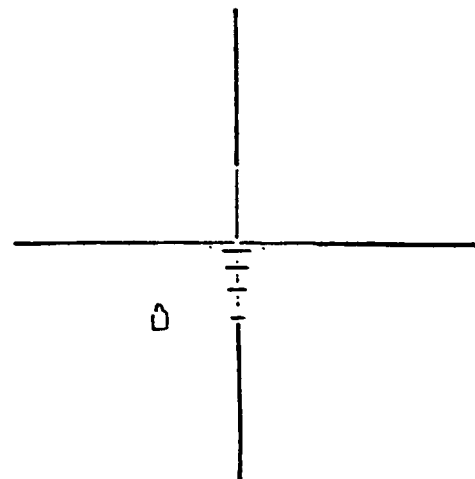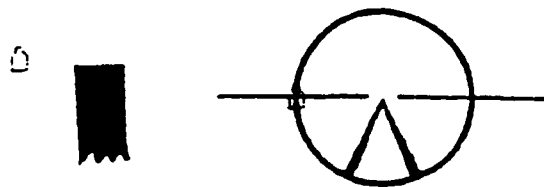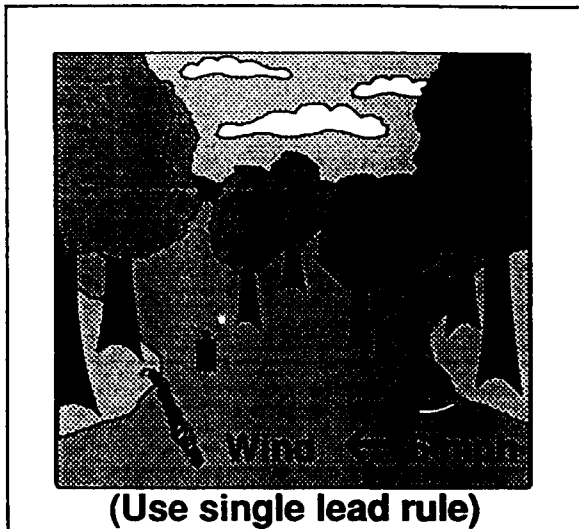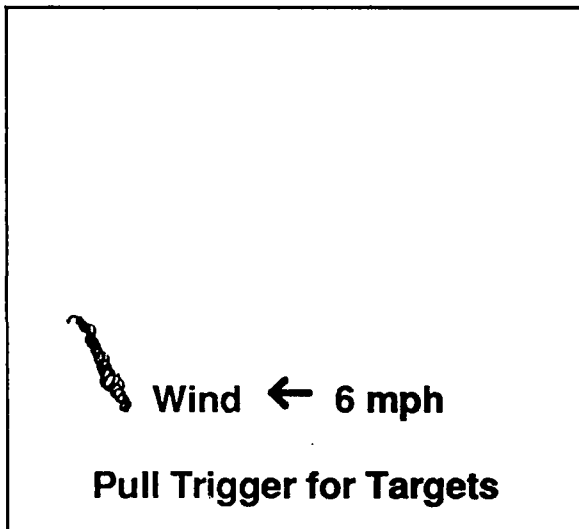
Playback. Displace sight 89 cm right. Bullet hits 92 cm left of aim.

5-83

600 M target.

5-84

Wind ↓ 10 mph

(Pull Trigger to Continue)
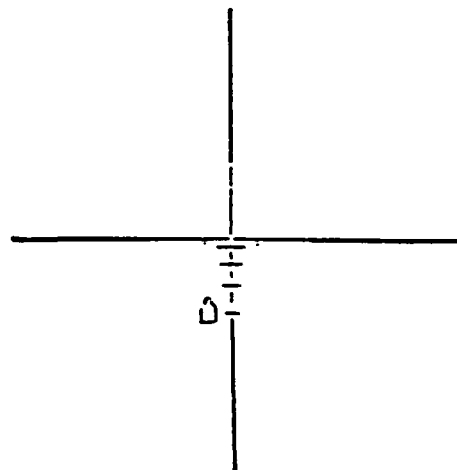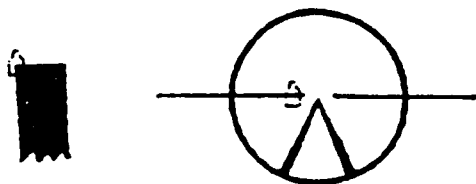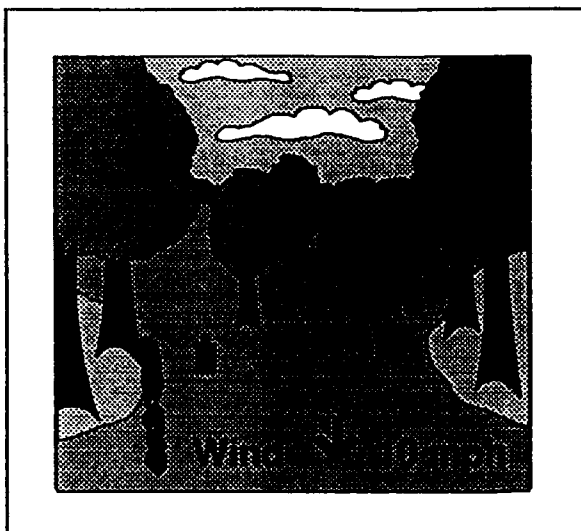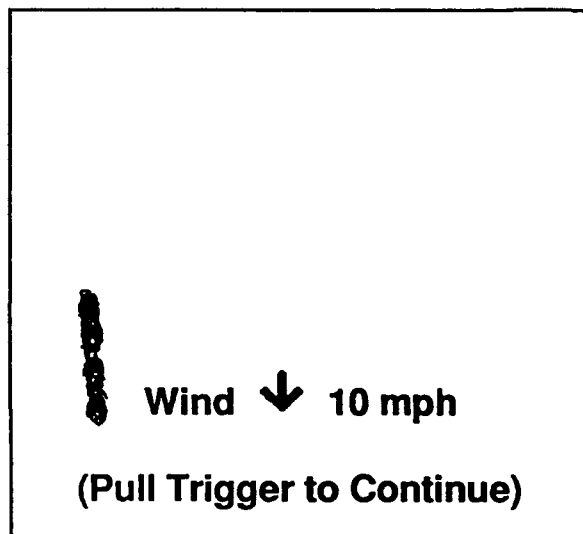
Playback. Center aim. Bullet hits aim point.
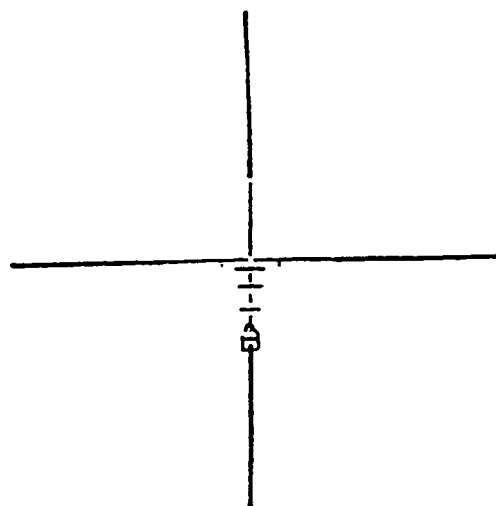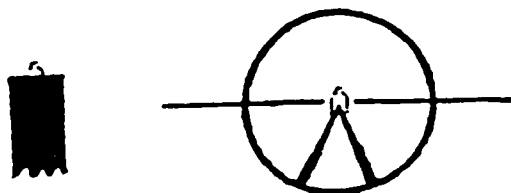
5-84a
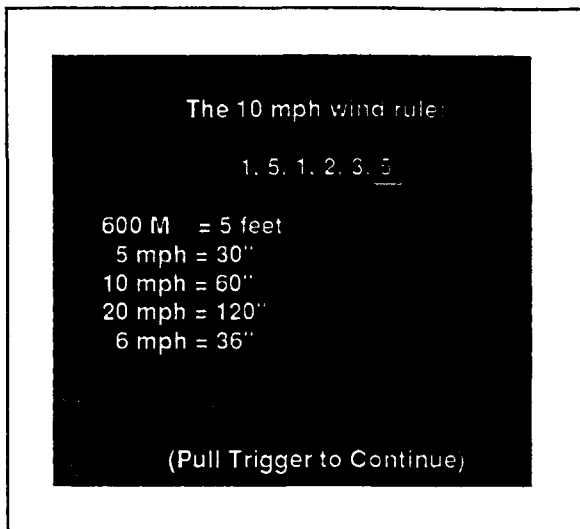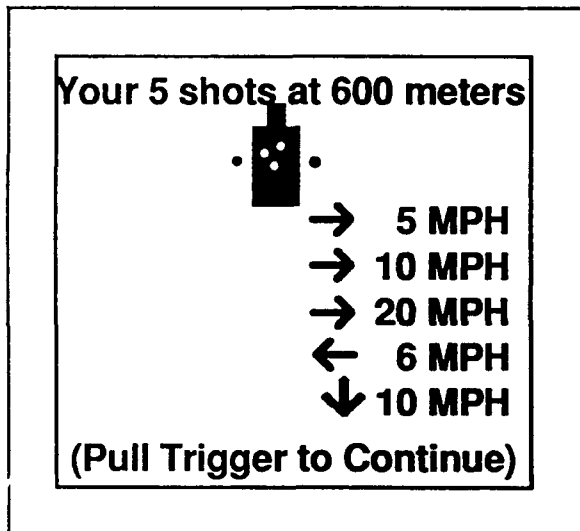
The 10 mph wind rule:

1. 5. 1. 2. 3. 5

600 M = 5 feet
  5 mph = 30"
 10 mph = 60"
 20 mph = 120"
  6 mph = 36"

(Pull Trigger to Continue)

5-85

Your 5 shots at 600 meters

→ 5 MPH
→ 10 MPH
→ 20 MPH
← 6 MPH
↓ 10 MPH

(Pull Trigger to Continue)

Target with 5 shot locations.

Showing the 5 shot locations, each bullet and corresponding arrow blink -- in sequence.

6-1

LEVEL
6

Battlefield Practice

(Stationary and
moving targets
under various wind
conditions)

(Pull trigger to continue)
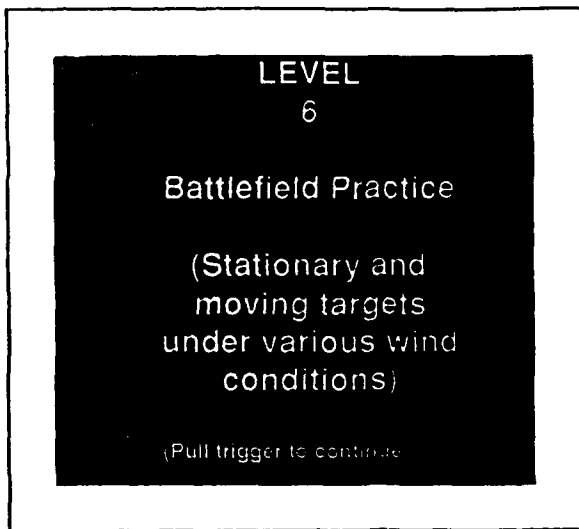
NOTE: Targets sized for screen.

400

300

250

200

185

100

75

6-2
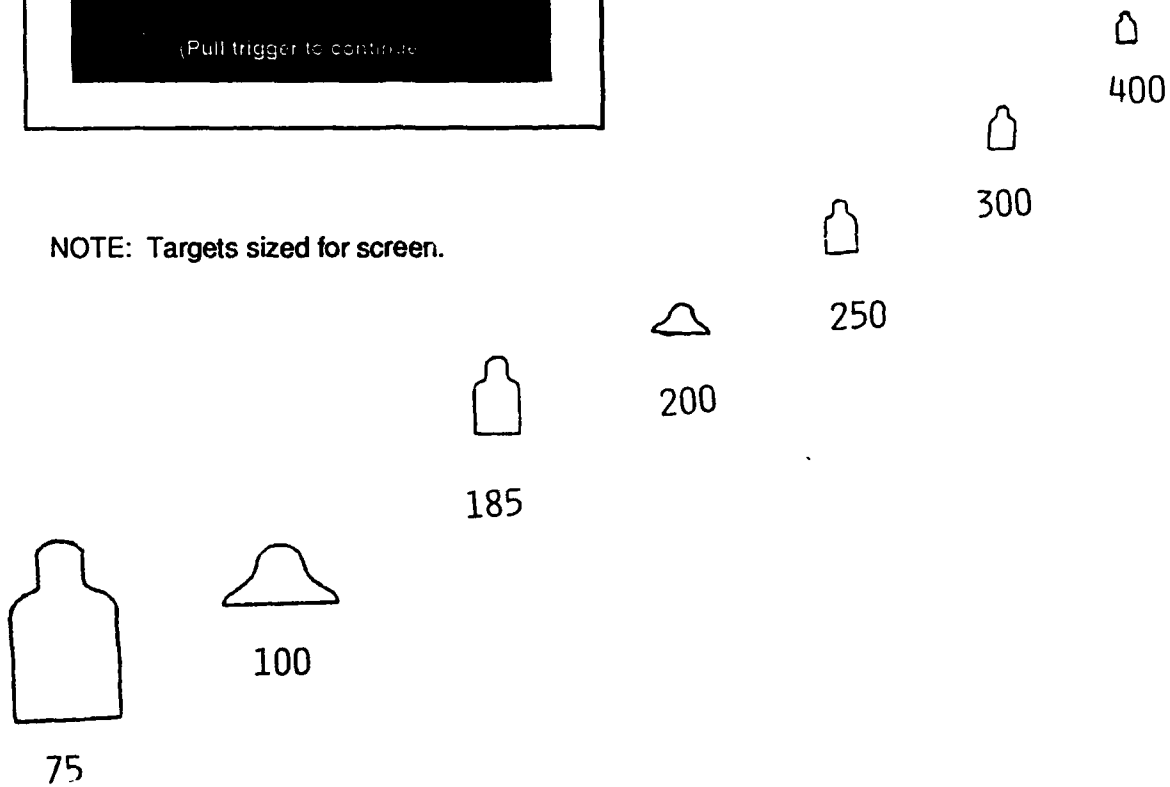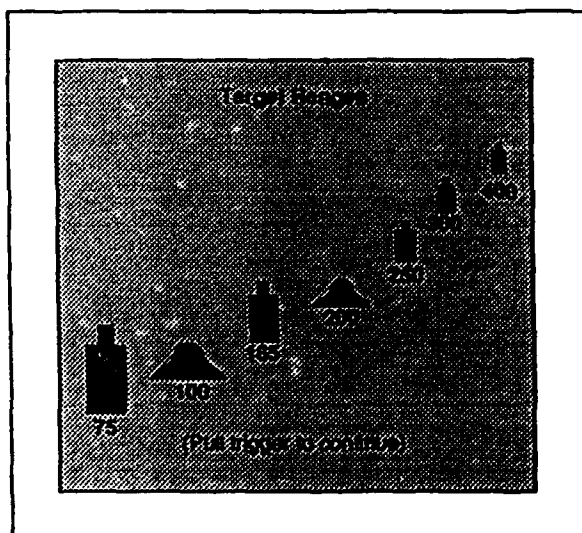
6-3

For this level,
sights will be set
at battlesight zero
of 300 meters for
all targets.

(Pull trigger to continue)

6-4

In review, remember
that bullets will be
centered around the
aim point only for
300 meter stationary
targets under no-
wind conditions.

(Pull trigger to continue)

6-5

Bullets will strike
above or below the
aim point as follows:

RANGE (M)	INCHES
75	
100	
185	
200	
250	
300	
400	

(Pull trigger to continue)

6-6

A 10 mph wind will
effect the bullet as
follows: (1. 5. 1. 2. 3. 5)

RANGE (M)	INCHES
75	3.4"
100	
185	4.5"
200	5"
250	6
300	12" (1 foot)
400	24" (2 feet)

(Pull trigger to continue)

6-7

The lead required
for a moving target
is:

Less than 150 m - 1 Lead

150 m or more:

1 - 3 mph - 1 Lead
4 - 6 mph - 2 Leads
7 - 8 mph - 3 Leads

(Pull trigger to continue)

6-8

The amount of bullet
displacement which
results from leads:

RANGE (M)	LEADS		
	1	2	3
75	4"	8"	12"
100	6"	12"	18"
185	11"	22"	33"
200	12"	24"	36"
250	15"	30"	45"
300	18"	36"	54"
400	23"	46"	69"

(Pull trigger to continue)

6-9

The aiming point
must be adjusted
to allow for range,
wind, and movement.
Carefully select the
aiming point for the
next target.

RANGE: 75 meters
WIND: —> 5 mph
TARGET SPEED: <— 5 mph

Pull trigger for target.

6-10
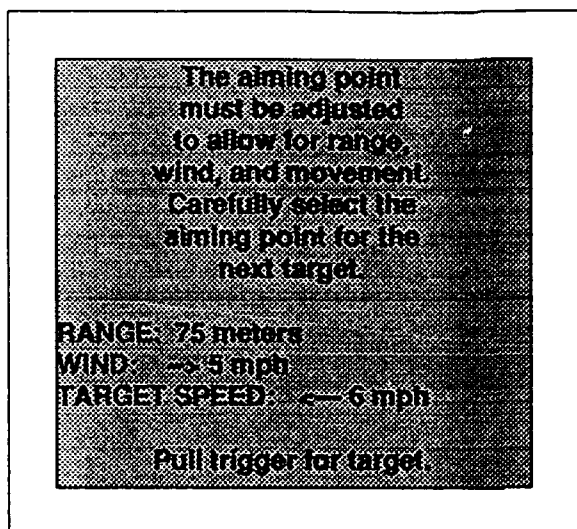
75M target moving Right to Left.
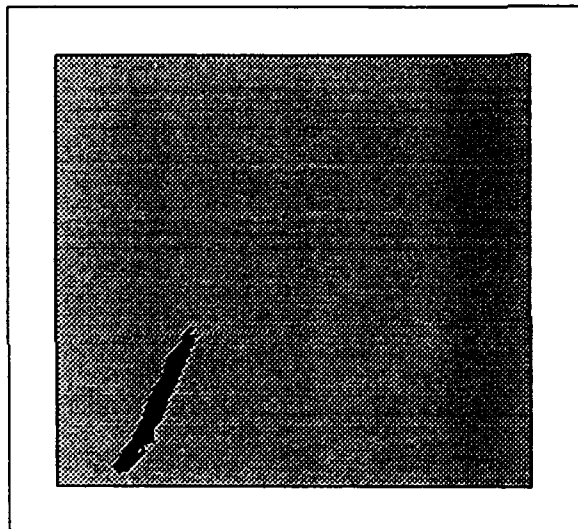
6-11

The next 10 replays
will show separate
aim points for range,
wind, and movement, as
well as the correct
aim point to hit
target center and
your aim point.

(Pull trigger to continue)

6-12

NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.
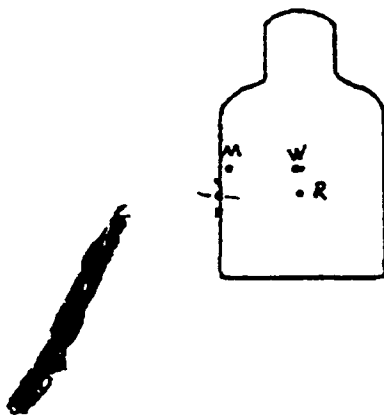
RANGE: 75 M
WIND: ---> 5 MPH
MOVING: <--- 6 MPH

✛ CORRECT AIM POINT

✛ YOUR AIM POINT

(Pull trigger for target)

6-13

100 M target.

6-14

RANGE: 100 M
WIND: —> 10 MPH

✛ CORRECT AIM POINT

✛ YOUR AIM POINT

(Pull trigger for target)
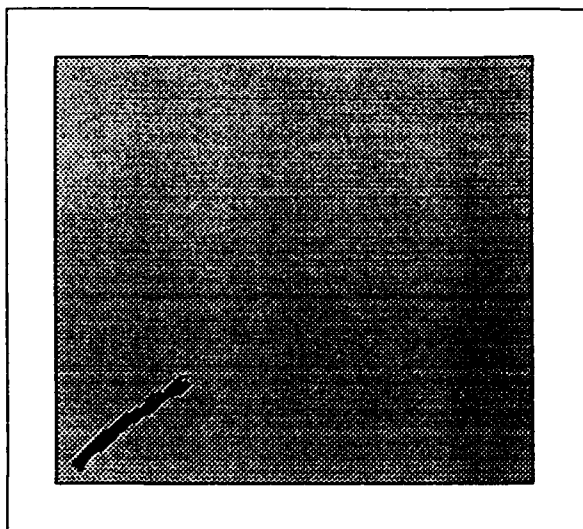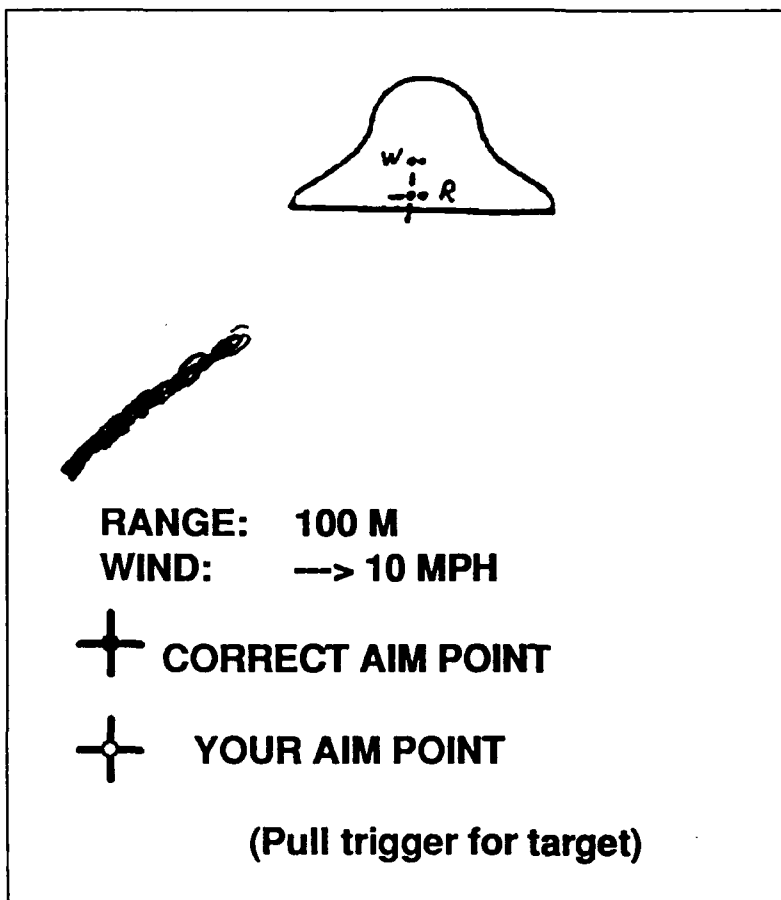
NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-15

185 M target.

6-16
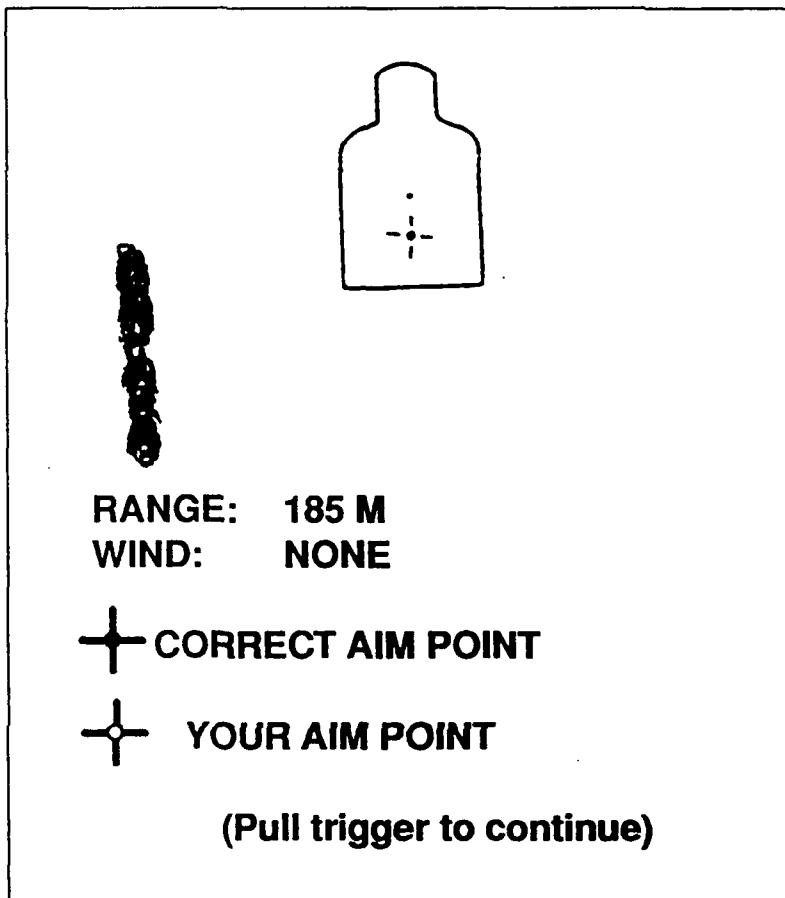
RANGE: 185 M
WIND: NONE

╈ CORRECT AIM POINT

╈ YOUR AIM POINT

(Pull trigger to continue)

NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

6-17

YOUR NEXT TARGET:

RANGE: 185 M
WIND: —> 10 Mph
MOVING: —> 15 Kph

(Pull trigger for target)
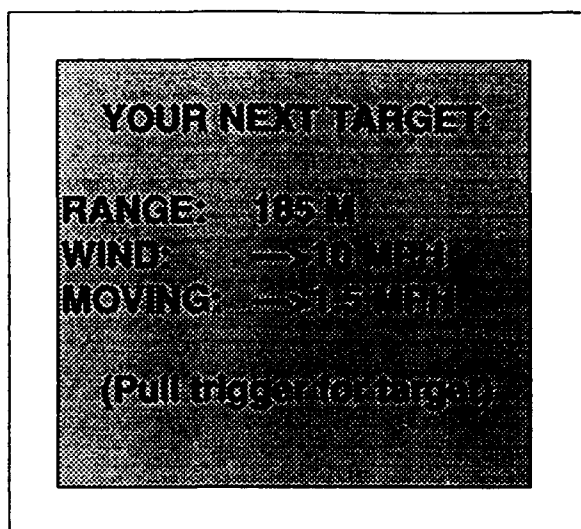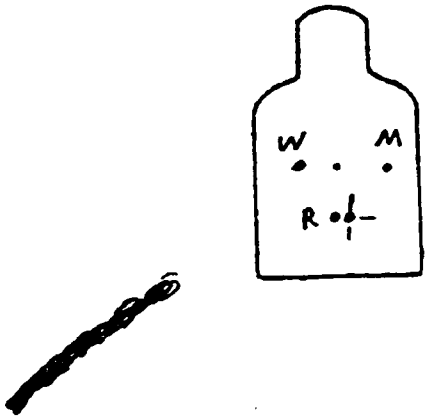
6-18
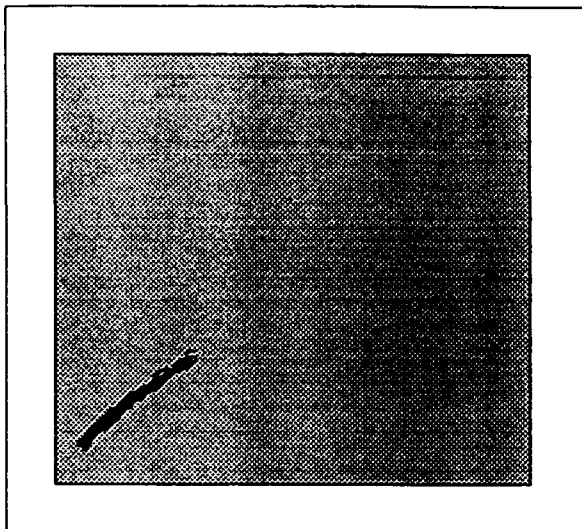
185 M target moving left to right at 1.5 mph.

6-19

NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

RANGE: 185 M
WIND: ---> 10 MPH
MOVING: ---> 1.5 MPH

+ CORRECT AIM POINT

+ YOUR AIM POINT

(Pull trigger for target)

6-20
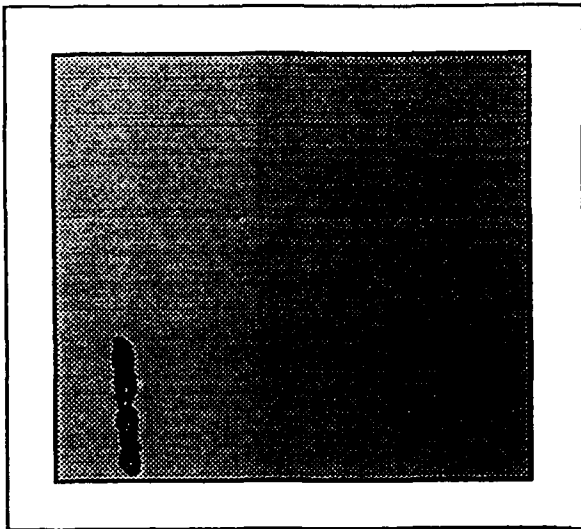
200 M target.

6-21
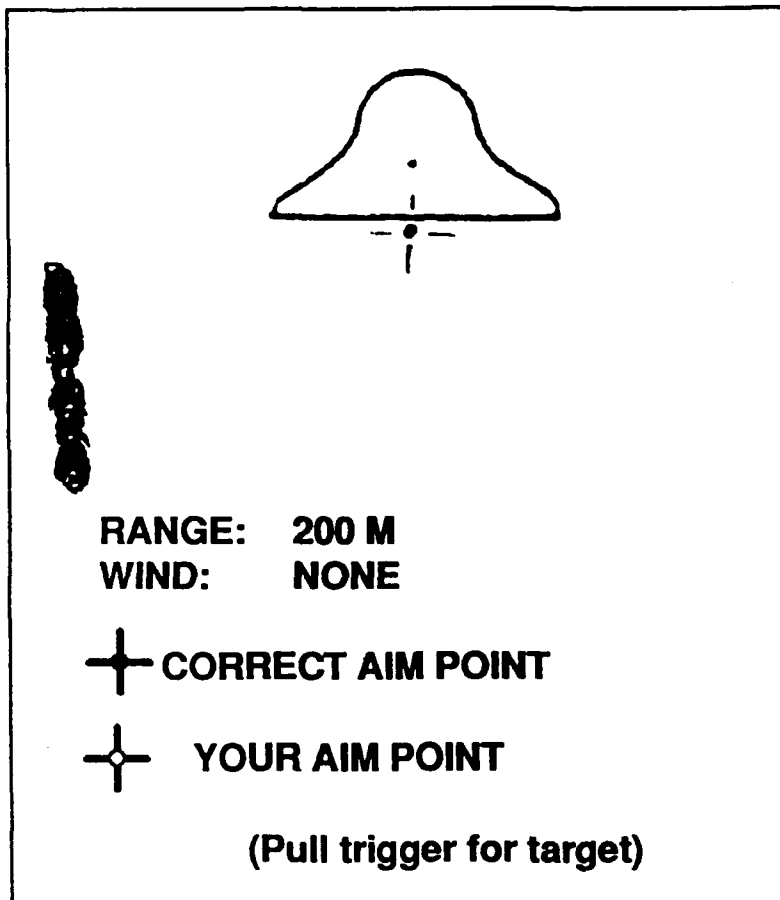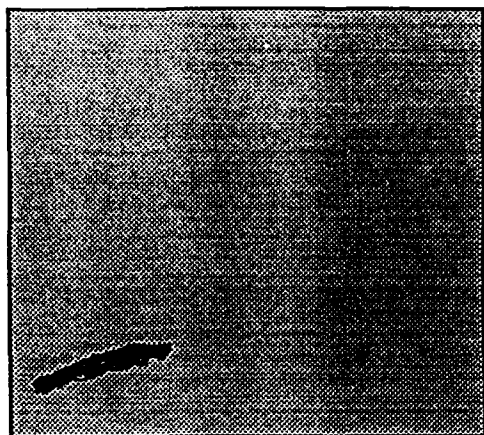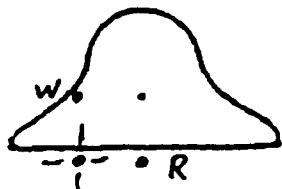
NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.

RANGE: 200 M
WIND: NONE

✚ CORRECT AIM POINT

✛ YOUR AIM POINT

(Pull trigger for target)

6-22

200 M target.

6-23

RANGE: 200 M
WIND: ---> 15 MPH

$+$ CORRECT AIM POINT
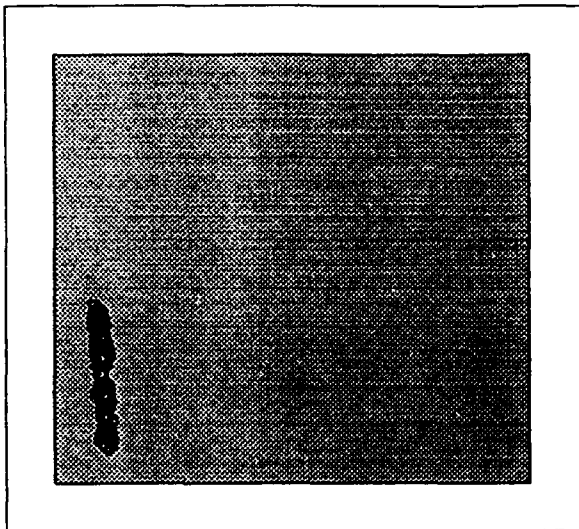
ϕ YOUR AIM POINT

(Pull trigger for target)

NOTE: In sequence,
flash range, wind,
and correct aim
with the
corresponding
aim point.

6-24

250 M target.

6-25

RANGE: 250 M
WIND: NONE

➕ CORRECT AIM POINT

➕ YOUR AIM POINT

(Pull trigger to continue)
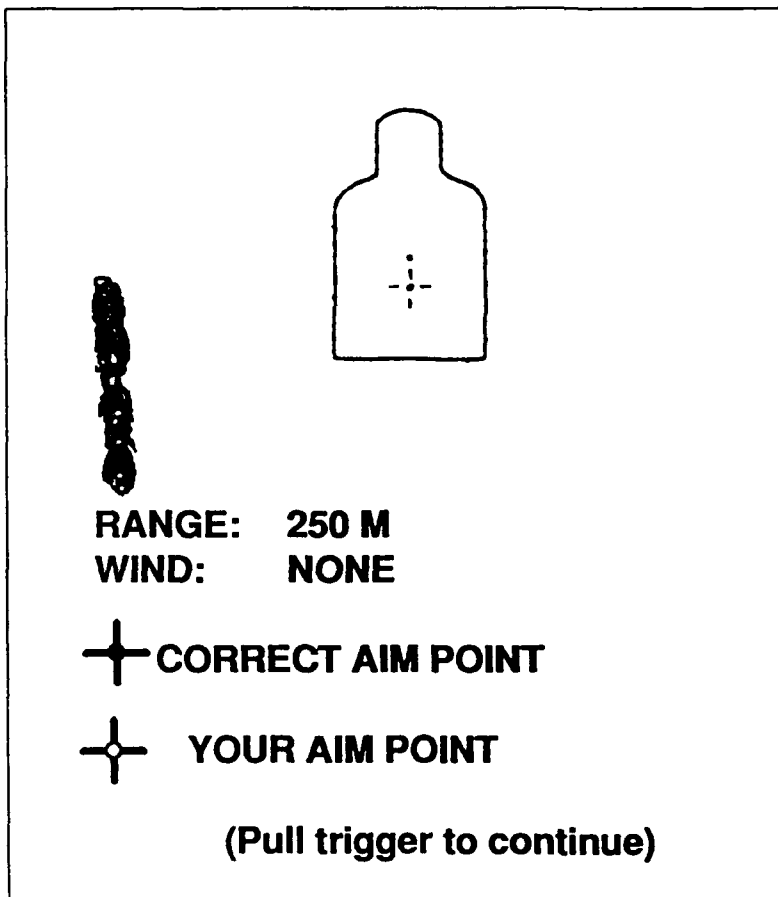
NOTE: In sequence,
flash range, wind,
and correct aim
with the
corresponding
aim point.

6-26

YOUR NEXT TARGET:

RANGE: 250 M

WIND: <—5 MPH

MOVING: —>2.5 MPH

(Pull trigger for target)

6-27
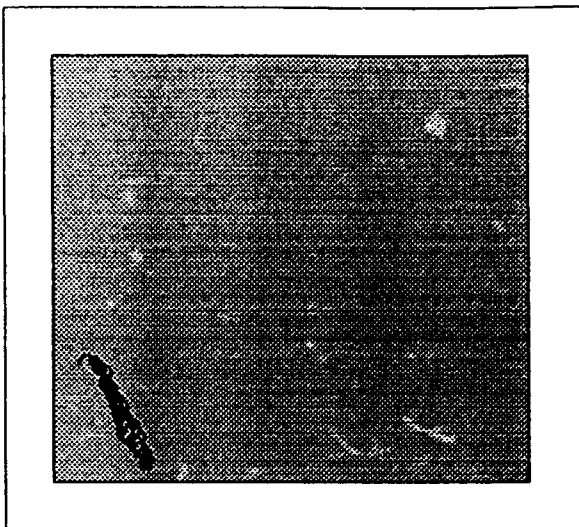
250 M target moving left to right at 2.5 mph.

6-28

RANGE: 250 M
WIND: <— 5 MPH
MOVING: —> 2.5 MPH

╀ CORRECT AIM POINT

╁ YOUR AIM POINT

(Pull trigger to continue)

NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

6-29

YOUR NEXT TARGET:

RANGE: 300 M
WIND: <—15 MPH
MOVING: <—3 MPH

(Pull trigger for target)

6-30
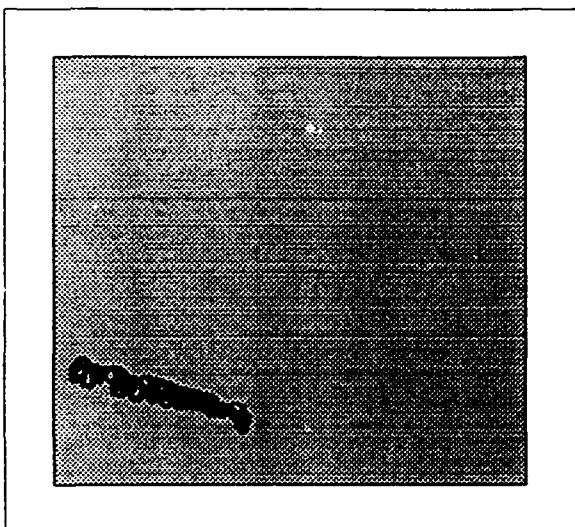
300 M target moving right to left at 3 mph.

6-31

NOTE: This is a blow-up. In sequence, flash range, wind, moving, and correct aim with the corresponding aim point.

M   R   W

RANGE: 300M
WIND: <— 15 MPH
MOVING: <— 3 MPH

✝ CORRECT AIM POINT
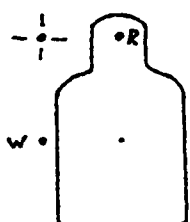
✝ YOUR AIM POINT

(Pull trigger to continue)

6-32

400 M target.

6-33

NOTE: In sequence, flash range, wind, and correct aim with the corresponding aim point.
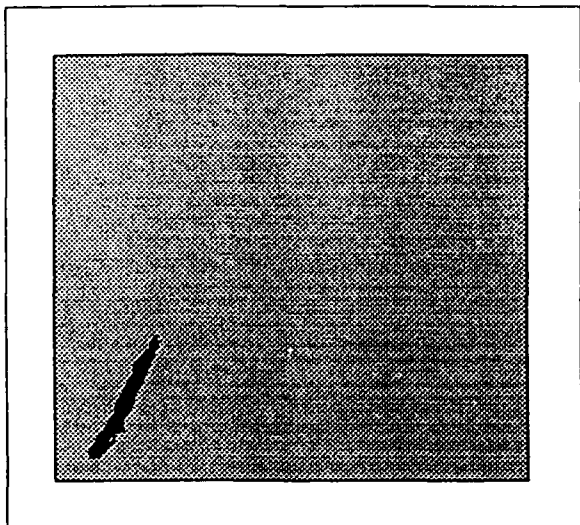
RANGE: 400M
WIND: ---> 5 MPH

✛ CORRECT AIM POINT

⊹ YOUR AIM POINT

(Pull trigger to continue)

6-34

FIRING EXERCISE

80 Targets
55 Stationary
25 Moving

100 Rounds
Wind: Rising Smoke
Standard: 65 of 80

Assume a Supported Position

(Pull trigger for target)
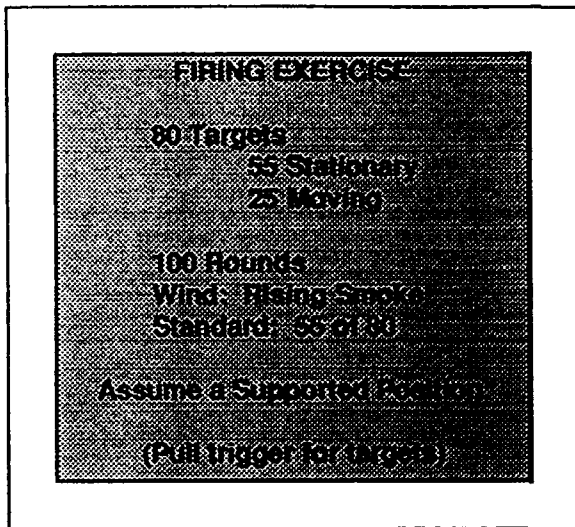
6-35 to 6-29

<--- Presentation of 80 targets --
general location of targets shown at
next page. Following pages outline
scenario.

400

300)

250

200

185

100

75
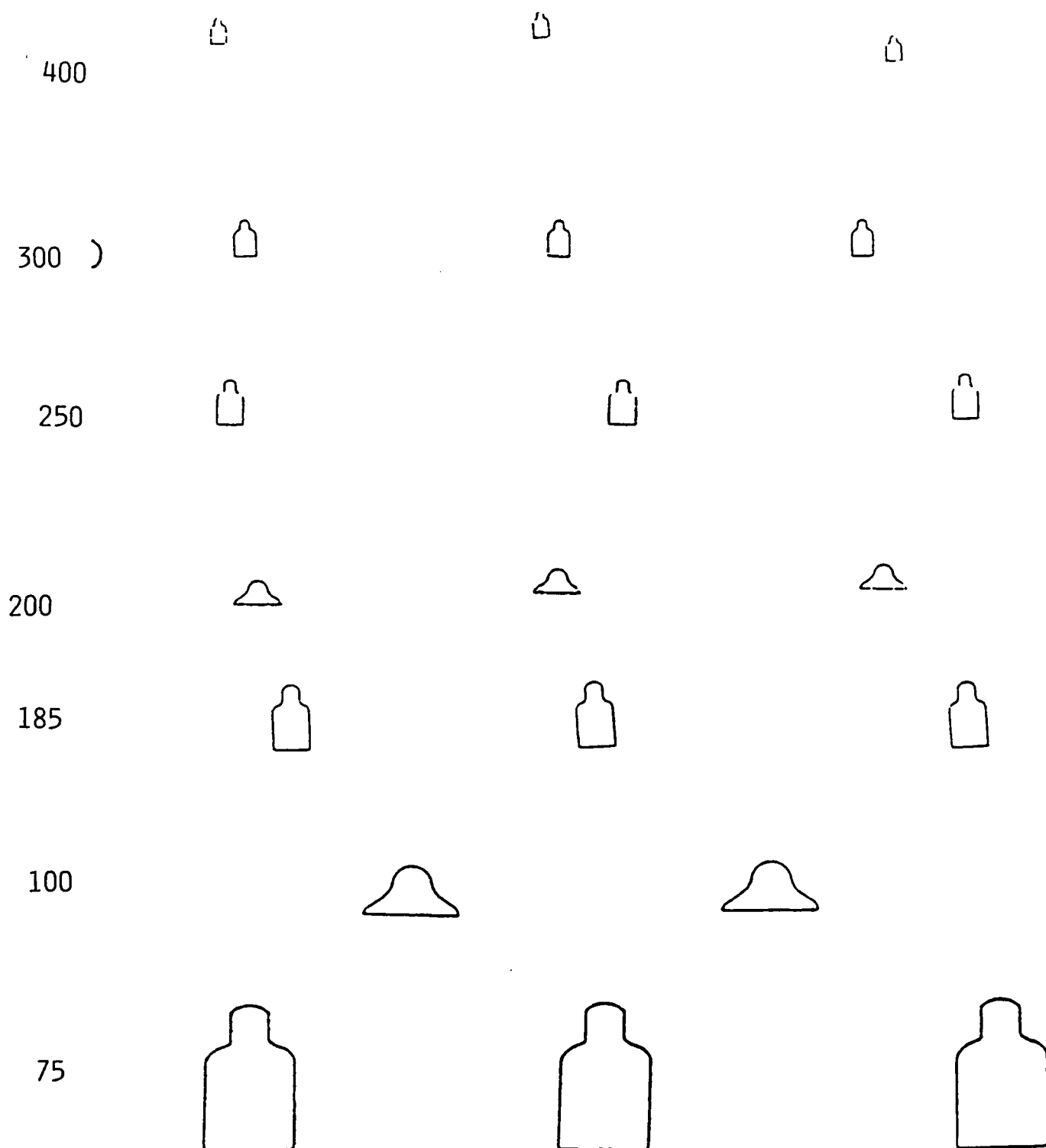
	WIND	RANGE	LOC	TIME/MOVEMENT	SHOT DISPLACEMENT (cm) FROM AIMING POINT
1.	5 --->	400	C	S 6 sec	40 cm low, 30 cm right
2.	5 --->	300	R	S 6 sec	—, 15 cm right
		250		---> 4 mph	10 cm high, 43 cm left
3.	5 --->	200	L	S 5 sec	15 cm high, 6 cm right
		250		---> 4 mph	10 cm high, 43 cm left
4.	5 --->	185		<— 6 mph	15 cm high, 60 cm right
		200	R	S 5 sec	15 cm high, 6 cm right
5.	10 -->	185		---> 6 mph	15 cm high, 56 cm left
		100	L	5 sec	10 cm high, 2 cm right
		100	R	5 sec	10 cm high, 2 cm right
6.	10 -->	400	L	S 8 sec	40 cm low, 60 cm right
		300		---> 6 mph	—, 80 cm left
7.	10 -->	400	R	S 8 sec	40 cm low, 60 cm right
		300		<— 6 mph	—, 132 cm right
8.	5 --->	400	C	S 8 sec	40 cm low, 30 cm right
		185	L	S 5 sec	15 cm low, 10 cm right
		185	R	S 5 sec	15 cm low, 10 cm right
9.	5 --->	250		---> 1.5 mph	10 cm low, 10 cm left
10.	0	300		S 5 sec	None
11.	0	185		<— 3 mph	15 cm low, 30 cm right
		200	L	6 sec	15 cm low, —
		200	C	6 sec	15 cm low, —
		200	R	6 sec	15 cm low, —
12.	0	75		---> 6 mph	8 cm low, 22 cm left
		100	L	4 sec	10 cm low, —
		100	R	4 sec	10 cm low, —

	WIND	RANGE	LOC	TIME/MOVEMENT	SHOT DISPLACEMENT (cm) FROM AIMING POINT
13.	0	250		----> 1.5 mph	10 cm low, 20 cm left
		75	L	S 4 sec	8 cm low, ---
		75	R	S 4 sec	8 cm low, ---
14.	5 <---	300	R	S 5 sec	---, 15 cm left
15.	5 <---	400	L	S 7 sec	40 cm low, 30 cm left
		250	R	S 5 sec	10 cm high, 10 cm left
16	10 <--	300	C	S 5 sec	---, 30 cm left
17.	20 <--	400	C	S 7 sec	40 cm low, 120 cm left
		200	R	S 5 sec	15 cm high, 25 cm left
18.	20 <--	300		<--- 4 mph	---, 5 cm right
		250		----> 3 mph	10 cm high, 80 cm left
19.	20 <--	200	L	S 7 sec	15 cm high, 25 cm left
		100	R	S 6 sec	10 cm high, 5 cm left
		75		<--- 4 mph	8 cm high, ---
20.	10 <--	200	R	S 7 sec	15 cm high, 12 cm left
		100	L	S 6 sec	10 cm high, 2 cm left
		75		----> 4 mph	8 cm high, 15 cm left
21.	5 <---	75	C	S 3 sec	8 cm high, ---
22.	0	185		----> 6 mph	15 cm high, 58 cm left
		200	L	S 6 sec	15 cm high, ---
23.	0	250		<--- 6 mph	10 cm high, 80 cm right
		300	L	S 6 sec	---, ---
24.	0	250	C	S 6 sec	10 cm high, ---
		200	L	S 4 sec	15 cm high, ---
		200	R	S 4 sec	15 cm high, ---
25	0	250		----> 3 mph	10 cm high, 40 cm left
		300	L	S 6 sec	---, ---

	WIND	RANGE	LOC	TIME/MOVEMENT	SHOT DISPLACEMENT (cm) FROM AIMING POINT
26.	0	400	L	S 7 sec	40 cm low, —
		400	R	S 10 sec	40 cm low, —
		300		—> 3 mph	—, 50 cm left
27.	0	400	L	S 9 sec	40 cm low, —
		300	C	S 7 sec	—, —
		250	R	S 5 sec	10 cm high, —
28.	0	300		<— 6 mph	—, 100 cm right
		200	L	S 5 sec	15 cm high, —
		200	R	S 5 sec	15 cm high, —
29.	0	250		<— 3 mph	10 cm high, 40 cm right
		185	R	S 5 sec	15 cm high, —
		75	L	S 3 sec	8 cm high,—
30	0	185		—> 5 mph	15 cm high, 48 cm left
31.	0	75		<— 6 mph	8 cm high, 22 cm right
32.	0	185		<— 3 mph	15 cm high, 30 cm right
		100	L	S 5 sec	10 cm high, —
		100	R	S 5 sec	10 cm high, —
33.	0	185		—> 3 mph	15 cm high, 30 cm left
		200	L	S 6 sec	15 cm high, —
		100	L	S 5 sec	10 cm high, —
34.	0	75	L	S 4 sec	8 cm high, —
		75	C	S 4 sec	8 cm high, —
		75	R	S 4 sec	8 cm high, —
35.	0	75		—> 6 mph	8 cm high, 22 cm left
		100	L	S	15 cm high, —
		100	R	S	15 cm high, —
		185	L	S	15 cm high, —

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	STATIONARY			MOVING	
RANGE	# TGT	HIT		# TGT	HIT
75	7	5		5	4
100	11	10		-	-
185	4	4		7	5
200	14	12		-	-
250	3	2		8	5
300	7	4		5	-
400	9	3		-	-
	55	40		25	17

(Pull trigger to continue)

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FIRING EXERCISE

STANDARD: HIT ...

YOUR SCORE: ...
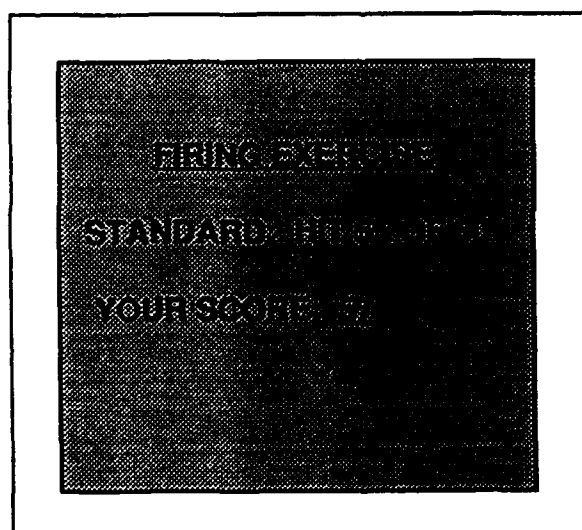
6-71
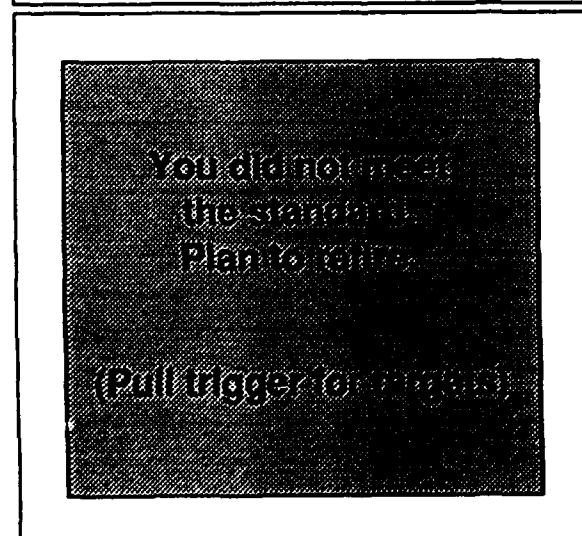
NOTE: If standard is not met.

You did not meet
the standard.
Plan to retire.

(Pull trigger for again)

A	B	C	D	E	F	G
H	I	J	K	L	M	N
O	P	Q	R	S	T	U
V	W	X	Y	Z		

Entry
Initial

- At the end of Level 6, high scorers may enter initials for display on high score screen. The high score screen will alternate with the MACS welcome screen until computer is turned off.

- Alternates with MACS welcome screen
- Activated after shooter fires high score on Level 6.

CONGRATULATIONS

You are finished
with this program.
Call instructor

DESCRIPTION OF THE MACS MENU

The MACS Menu provides flexibility for the instructor using the MACS program.

To access the MACS program menu, press the [RUN STOP] key:

- · At the MACS   Introductory screen.
- · At any Level screen.
- · Repeatedly during a level when a target is on the screen.

THE MACS MENU FOR INFANTRY RIFLE MARKSMANSHIP

Level Order:
1 2 3 4 5 6
1 - Fundamentals -- Stationary Targets
2 - Fundamentals -- Moving Targets
3 - Long Range Stationary
4 - Long Range Movers
5 - Wind Effects
6 - Battlefield Practice

L: Change Level Order
N: New Firer
C: Set Crosshair for Level 6
LP: Light Pen Mount Adjustment

Select number or letter & press RETURN
? -

SELECT LEVELS

- Permits instructor to select level/s desired and to have shooter shoot them in the order designated.

Chose Level Order:
Type a number (1-6) for the desired level, in the desired order of presentation. Type 0 and press **RETURN** when done.

    1: ?___
    2:
    3:
    4:
    5:
    6:

NEW FIRER OPTION

- Program returns to Establish Zero Screen.
- Used when one firer has completed firing and a new firer begins.

-------------- Select letter & press RETURN
       ?-N

SET CROSSHAIR STATUS FOR LEVEL 6

Choose Cross Hair option----- Select letter & press RETURN
                    ? - C

Set Cross Hair for Level 6 screen appears.

    1.   Cross hair appears after each shot.

    2.   Cross hair appears only when target is missed.

    3.   No crosshair on Level 6.

    Type the number (1-3) of your choice? _____

NOTE: When option 1 or 2 has been selected ,the menu screen will highlight the SET CROSS HAIR FOR LEVEL 6 in yellow to indicate to the instructor that the program is operating in a mode other than Default (Option 3).

LIGHT PEN MOUNT ADJUSTMENT OPTION

· Follow procedures outlined on pages 2-1 through 2-8 of the MACS BRM Trainer's Guide.

APPENDIX B

NEW LIGHT PEN CALIBRATION PROGRAM

NEW LIGHT PEN CALIBRATION PROGRAM

The light pen calibration program currently in use in MACS cartridges is a BASIC program which reads the light pen port and displays information about the screen location of the light pen. Because this program is written in BASIC, it is slow and does not take readings at the same rate as the firing programs in the cartridges (60 readings per second).

A test calibration program has been developed in assembler so that the maximum number of readings per second may be obtained. However, at this speed, the computer is unable to print the X and Y cartesian coordinates in the upper left hand corner. Instead, a bar graph simulating light pen movement is displayed at the top of the screen whenever the light pen is reading within the designated box at the center of the screen. The top row indicated the X readings at 60/second while the second row indicates Y readings at 60/second.

As another part of this test, an averaging routine was developed in an attempt to make readings appear "smoother." Because of the speed at which the calculations must be performed, and because of the binary nature of the computer, it is necessary to create an average based on a number of readings which is divisible by a power of 2. 2, 4, 8, and 16 reduces the sampling rate to 30/second. Taking an average based on 2 readings per second reduces the sampling rate to 30/second. An average based on 4 readings per second reduces the sampling rate to 15/second. I don't feel that 2 readings will produce an adequate sampling, yet 4 readings reduces the sampling rate quite a bit. As a compromise, I have developed the following algorithm: (1) take the first 4 readings and find the average; (2) take the next 3 readings and average them with the previous average. This produces an average based on 4 readings, yet allows a sampling rate of 20/second. The following serves as additional illustration:

```
---------------------------------------------------------------
-
Reading:
/   1  /   2  /   3  /   4  /   5  /   6  /   7  /   8  /   9  / 10
/
---------------------------------------------------------------
-
/   A1=(R1+R2+R3+R4)/4      /
                         / A2=(A1+R5+R6+R7)/4 /
                                           /A3=(A2+R8+R9+R10+)/4
/
---------------------------------------------------------------
-
```

The third and fourth lines of the calibration screen display a bar graph depicting the results of averaging the X and Y values in this manner. A small 2X2 dot appears where the light pen is pointed, based on an unaltered 60 readings per second.

APPENDIX C

DOCUMENTATION -- MOVING TARGET PROGRAM WITH RETICLE
OPTION (THE SAME DOCUMENTATION CHANGES APPLY TO THE
BASIC RIFLE MARKSMANSHIP PROGRAM WITH RETICLE OPTION)

```
*=3200
;ARM.3200.TXT FOR ARM PROGRAM
        JMP     ENABLE  :3200
        JMP     DSABLE  :3203
        JMP     ROTATE  :3206
        JMP     MOTTRG  :3209
        JMP     BANG    :3212
        JMP     WHISTL  :3215
        JMP     WAIT    :3218
        JMP     SCENE   :3221
        JMP     SEEVAL  :3224
        JMP     COLORS  :3227
        JMP     HITMIS  :3230
        JMP     MATH    :3233
        JMP     ADJLOC  :3236
        JMP     TRKTRP  :3239
        JMP     SHTGRP  :3242
        JMP     BITPLT  :3245
        .OPT    NOL
EXPTAR =32792
SELSUB =49162
SUBNO  =49168
;
;               CONVENTIONS USED
;PROCEDURE XXXXX
;PURPOSE OF PROCEDURE
;NECESSARY ACTIONS BEFORE CALL
;HOW TO CALL
;WHAT USER CAN EXPECT AFTER CALL
;
        .LIB    MACROS-VARS
        .OPT    NOL
;820-1023 IS UNUSED IF NO CASSETTE
CHOICE =820
STOP   =821
HOLD1  =823
HOLD2  =824
NSRT   =825
HOLDA  =826
HOLDX  =827
NUMRD  =828
NUMR20 =829
HOLD   =831
DELAY  =832
CUR1   =833
OFFX   =834
OFFY   =836
SHOTS  =838
N1IRQ  =839
N2IRQ  =840
N3IRQ  =841
N4IRQ  =842
N5IRQ  =843
N6IRQ  =844
N7IRQ  =845
N8IRQ  =846
XVAL   =847   ;X BULLET STRIKE
YVAL   =849   ;Y BULLET STRIKE
SORTAF =851   ;# RDGS TO SORT AFTER
STSIZE =852   ;# TO PUT IN SRTBUF
SRTBUF =853
CURSRT =863
HOLDY  =864
TRAJ   =866
IRQ    =867
SSCOL  =868
SDCOL  =869
FLAGS  =870
CODE1  =871

CODE2  =872
COLOR  =873
OFFSCR =874
HAFSEC =875
TERORD =876
CRSDLA =878
CURTF  =879
HOLD3  =880
HOLD4  =881
CURTAR =882
CUR2   =883
IRQ2   =884
COPY   =885
CODE3  =886
CODE4  =887
TARPRE =888
NUMR50 =889
HOLDAD =891
HITSPR =893
SUMX   =894
NSIZE  =896
TIMES  =897
PSTAT  =898
MAXSHT =899
LASTSH =900
HITS   =910
MISSES =911
PENAL  =912
PINFO  =913
MAXVAL =928
WIND   =929
WDRIFT =930
SHOTRK =932
KEYMSK =933
CURNUM =934
BORCOL =936
LPCHPX =937
LPCHPY =938
METHEN =939
X1     =940
Y1     =942
X2     =944
Y2     =946
;NEXT ONE AT 948
CENX   =15872
CENY   =15880
TARNUM =15888
SPECIL =15896
YDRIFT =15904
XDRIFT =15912
TLIM1  =15920
TLIM2  =15928
TIMFL1 =15936
TIMFL2 =15944
INSTR  =15952
CDLSTK =15960
DLSTK1 =15968
DLSTK2 =15976
;NEXT ONE AT 15984
;
LENSTR =16383
ADD    =SB86F
CHKIN  =SFFC6
CHKOUT =SFFC9
CHRIN  =SFFCF
CLOSE  =SFFC3
CLRCHN =SFFCC
CHROUT =SFFD2
DIVIDE =SBB12

FL15C  =SBBC7
FA1FA2 =SBC0F
FA1MEM =SBBD4
FLOAT  =SB391
GETIN  =SFFE4
LOAD   =SFFD5
MEMFA1 =SBBA2
MEMFA2 =SBA8C
MLTPLY =SBA2B
OPEN   =SFFC0
SETLFS =SFFBA
SETNAM =SFFBD
SQRT   =SBF71
SUBTRT =SB853
UNPLOT =SB1BF
V      =SD000
SID    =SD400
TEMP   =16192
XLPB20 =40960 ;UNDERNEATH ROM
YLPB20 =41472 ;UNDERNEATH ROM
XTGB20 =41984 ;UNDERNEATH ROM
YTGB20 =42496 ;UNDERNEATH ROM
XLPB60 =43008 ;UNDERNEATH ROM
YLPB60 =43264 ;UNDERNEATH ROM
XTGB60 =43520 ;UNDERNEATH ROM
YTGB60 =43776 ;UNDERNEATH ROM
XLPA60 =44032 ;UNDERNEATH ROM
YLPA60 =44062 ;UNDERNEATH ROM
XTGA60 =44092 ;UNDERNEATH ROM
YTGA60 =44122 ;UNDERNEATH ROM
INFO   =44152 ;UNDERNEATH ROM
INFO2  =44496 ;UNDERNEATH ROM
HLDBUF =44840 ;UNDERNEATH ROM
;NEXT ONE AT 44840
RAMTAR =52224
        .MAC    DINC    ;DOUBLE
        INC     ?1      ;PRECISION
        BNE     ?2      ;INCREMENT
        INC     ?1+1
?2      .END
        .MAC    ADDR    ;MOVE LOW
        LDA     #<?2    ;BYTE OF ?2
        STA     ?1      ;INTO ?1 AND
        LDA     #>?2    ;HIGH BYTE OF
        STA     ?1+1    ;?2 INTO ?1+1
        .END
        .MAC    MOVE
        LDA     ?2
        STA     ?1
        LDA     ?2+1
        STA     ?1+1
        .END
        .MAC    DISK    ;DISK
        LDA     #8      ;OPERATIONS
        TAX             ;LOAD"?2",8
        LDY     #?1     ;?3 IS END OF
        JSR     SETLFS  ;FILE NAME.
        LDA     #?3-?2  ;THUS LENGTH
        LDX     #<?2    ;OF FILE NAME
        LDY     #>?2    ;IF ?3-?2
        JSR     SETNAM
        LDA     #0
        .END
        .MAC    PRINT
        LDA     #<?1
        LDY     #>?1
        JSR     SABLE   ;PRINT
        .END
        .MAC    PUTR

        PHA
        TYA
        PHA
        TXA
        PHA
        .END
        .MAC    GETR
        PLA
        TAX
        PLA
        TAY
        PLA
        .END
        .MAC    DADD
        LDA     ?1
        CLC
        ADC     ?2
        STA     ?1
        LDA     ?1+1
        ADC     ?2+1
        STA     ?1+1
        .END
        .MAC    DSUB
        LDA     ?1
        SEC
        SBC     ?2
        STA     ?1
        LDA     ?1+1
        SBC     ?2+1
        STA     ?1+1
        .END
        .MAC    PLOT
        LDY     #?1
        LDX     #?2
        CLC
        JSR     SFFF0
        .END
        .MAC    DSPL
        LDA     #?2-?1
        STA     LENSTR
        LDA     #<?1
        STA     SA3
        LDA     #>?1
        STA     SA4
        JSR     LETHL
        .END
        .OPT    LIST
        .END
        .OPT    NOL
        .LIB    IRQSTUFF
;IRQSTUFF FOR ARM PROGRAM
;PROCEDURE ENABLE
;PREPARES IRQ TO TAKE READINGS
;B:NONE
;C:SYS ENABLE
;A:NONE
ENABLE  SEI
        LDA     #0
        STA     56334
        LDA     53265
        AND     #127
        STA     53265
        LDA     #250
        STA     53266
        LDA     #5
        STA     53274
        LDA     53273
        STA     53273
        ADDR    S314,START
```

```
        LDA   #0                          :   8:INCREMENT (FOR INSTR:        STA   V+21    : TARGET UP      LDA   #128
        STA   CUR1    :20 EDGS SP          :   9:TIME/FLIGHT (#PIXELS/BYTS)  BIT   IRQ2                    STA   B3IRQ   :SPRITE BIT
        STA   CUR2    :60 EDGS SF          :     LOW NYB :1ST NVNT           BPC   IRQ050          IRQ160 LDA   B3IRQ
        STA   IRQ                          :     HIGH NYB:2ND NVNT           CMP   #0                      EOR   #255    :NOT SPRITE
        STA   BORCOL                       :  10:X DRIFT                     BNE   IRQ050                  STA   B4IRQ   : BIT
        STA   NUMRD   :# EDGS BEF          :  11:Y DRIFT                     LDA   IRQ                     LDA   V+21
        STA   SORTLF  :# SORT LF           :  12:BIT 7:NOT A TARGET          AND   #5?                     AND   B3IRQ
        LDA   #5                           :        6:REVERSE DIRECTION      STA   IRQ                     BEQ   IRQ190  :SPRITE OFF
        STA   STSIZE                       :        5:TER MORE THAN 1 SPR    JMP   SEA31   :NORMAL IRQ     LDA   TLIM1.X
        LDA   #1                           :        4:DON'T ADD TO TARPRE IRQ050 LDA   #u                  BMI   IRQ160  :NO LIMIT
        STA   HAFSEC                       :  13:Z CENTER OF MASS OFFSET/2   STA   HITSPR                  DEC   TLIM1.X
        STA   B7IRQ                        :  14:Y CENTER OF MASS OFFSET IRQ060 LDA   IRQ     :TAKE ANY    BNE   IRQ180  :MORE TIME
        CLI                                :  15:DELAY. 2ND NVNT             AND   #192    : READINGS?     LDA   TLIM1.X :LIMIT FOR
        RTS                                :                                 BNE   IRQ070                  BEQ   IRQ170  : 2ND NVNT
                                           :INFO IS SAVED AS FOLLOWS:        LDA   #0                      STA   TLIM1.X
:                                          :BYTE 0:TARGET # (FOR ID)         STA   CUR1                    LDA   #0
:PROCEDURE DSABLE                          :     1:BULLET X/2                STA   CUR2                    STA   TLIM2.X
:RETURNS IRQ VECTOR TO NORMAL              :     2:BULLET Y                  STA   BORCOL                  LDA   TIMFL2.X
:B:NONE                                    :     3:TARGET X/2                JMP   SEA31   :NORMAL IRQ     STA   TIMFL1.X
:C:SYS DSABLE                              :     4:TARGET Y              IRQ070 LDA   SFB     :SAVE        LDA   DLSTK2.X
:A:NONE                                    :     5:NUMRB (LOW)                PHA           : SFB & SFC    STA   DLSTK1.X
DSABLE SEI                                 :     6:NUMRB (HIGH)               LDA   SFC                     STA   CDLSTK.X
        LDA   #1                     START LDA   #4                          PHA                           JMP   IRQ180
        STA   56334                        BIT   53273                       DEC   HAFSEC  :NEW TARGET? IRQ170 LDA   B3IRQ  :TIME LIMIT
        LDA   #240                         BEQ   CONTIN                      BEQ   IRQ080  : /TIME LIM?    ORA   OFFSCR  : EXPIRED
        STA   53274                        LDA   53273                       JMP   IRQ270  :NOT TIME       STA   OFFSCR
        LDA   53273                        STA   53273              IRQ080 LDA   #30     :RESTORE         LDA   #128
        STA   53273                        JMP   SFEBC                       STA   HAFSEC  : HALF SEC      STA   TLIM1.X
        ADDR  S314.SEA31               CONTIN LDA   53265                    MOVE  SFB.TARORD              LDA   OFFSCR  :HAS TIME
        CLI                                 AND   #127                IRQ090 LDY   #255                    EOR   #255    : EXPIRED
        RTS                                 STA   53265                      LDA   IRQ     :IS TARGET      AND   V+21    : ON ALL
:                                           LDA   #250                       AND   #2      : CHECK         BNE   IRQ180  : TARGETS?
:PROCEDURE START (IRQ)                      STA   53266                      BNE   IRQ140  : DISABLED?     LDA   #54
:INTERRUPT CONTROLLER ROUTINE               LDA   53273                      LDY   #0                      STA   FSTAT
:                                           STA   53273                      LDA   (SFB).Y :# TARGETS IRQ180 JMP   IRQ250
:IRQ HAS THE FOLLOWING VALUES:              LDA   IRQ2                       CMP   #255             IRQ190 LDA   B5IRQ   :TARGET NEED
:128: TAKE READINGS BEFORE                  AND   #1                         BNE   IRQ100                  BEQ   IRQ180  : TO GO UP?
: 64: TAKE READINGS AFTER                   BEQ   IRQ010                     LDA   #32                     DEC   B5IRQ   :1 LESS TAR
: 32: GET COLLISION DATA                    JMP   REPLAY                     STA   FSTAT                   LDA   B4IRQ   :CLEAR
: 16: SOUND NEEDED                   IRQ010 LDX   V+30    :SPR/SPR           DINC  TARORD                  AND   V+23    : EXPAND Y
:  8: WAITING FOR TRIGGER RELEASE           LDY   V+31    :SPRITE/DATA       LDA   IRQ     :DON'T TAKE     STA   V+23
:  4: SHOT HAS BEEN FIRED                   LDA   IRQ                        AND   #63     : ANY MORE      LDA   B4IRQ   :CLEAR
:  2: NEW TARGET DISABLE                    AND   #32      :COLLISION        STA   IRQ     : EDGS IF       AND   V+29    : EXPAND X
:  1: NO BULLETS LEFT                       BEQ   IRQ020                     JMP   IRQ360  : NO TARGETS    STA   V+29
:                                           STZ   SSCOL                IRQ100 CMP   #254                   LDA   B4IRQ   :CLEAR
:IRQ2 HAS THE FOLLOWING VALUES:             STY   SDCOL                      BNE   IRQ110                  AND   V+16    : RIGHT X
:128: RETURN AFTER ONE SHOT FIRED           LDA   IRQ     :CLEAR             LDA   IRQ                     STA   V+15
: 64: RETURN WHEN NO TARGETS UP             AND   #223    : COLLISION        ORA   #2                      TXA             :X=X*2
: 32: NO HIT/MISS DETECTION                 STA   IRQ     : FLAG             STA   IRQ                     ASL   A
: 16: NO CROSS DISPLAYED               IRQ020 LDA   IRQ                      JMP   IRQ140                  TAX
:  8: CROSS FOR MISS ONLY                   AND   #16                 IRQ110 CMP   #253    :WHISTLE?       LDA   (SFB).Y :X COORD
:  4: NO DATA SAVE TO INFO2                 BEQ   IRQ030                     BNE   IRQ130                  STA   V.X
:  2: DISPLAY TARGET NUMBER                 :PLAY ANY SOUNDS HERE            LDA   OFFSCR  :SET FLAG       INY
:  1: REPLAY                          IRQ030 LDA   IRQ     :WAITING FOR      ORA   #1                      LDA   (SFB).Y :Y COORD
:                                           AND   #8      : TRIGGER          STA   OFFSCR                  STA   V+1.X
:TARORD (TARGET ORDER) IS SET UP            BEQ   IRQ040  : RELEASE?  IRQ120 DINC  SFB                     INY
:IN THE FOLLOWING MANNER:                   LDA   56321   :YES:HAS IT        JMP   IRQ090                  TXA             :X=X/2
:BYTE 0:# TARGETS THIS HALF SECOND          CMP   #247    : BEEN      IRQ130 CMP   #128    :DELAY          LSR   A
:      1:STARTING X COORDINATE              BEQ   IRQ040  : RELEASED         BCC   IRQ150                  TAX
:      2:STARTING Y COORDINATE              LDA   IRQ     :YES:CLEAR         SEC                           LDA   (SFB).Y
:      3:TARGET # (FOR ID)                  AND   #247    : FLAG             SBC   #1                      STA   TARNUM.X
:      4:TARGET SPRITE POINTER              STA   IRQ                        STA   (SFB).Y                 INY
:      5:BIT 7:SET TO EXPAND X        IRQ040 LDA   CRSDLA  :CROSS ON?        CMP   #128                    LDA   (SFB).Y :SPRITE PTR
:        6:SET TO EXPAND Y                   BEQ   IRQ060                     BEQ   IRQ120                  STA   2040.X
:        5:RIGHT X                          DEC   CRSDLA                     DEY                           INY
:        0-3:SPRITE COLOR                   BNE   IRQ050                IRQ140 LDA   #0                     LDA   (SFB).Y :EXPAND X?
:      6:TIME LIMIT (SECONDS)               LDA   HITSPR  :TURN OFF    IRQ150 STA   B5IRQ   :TARGETS       BPL   IRQ200
:        LOW NYB :1ST NVNT                  EOR   #255    : CROSS AND        INY                           LDA   V+29    :YES
:        HIGH NYB:2ND NVNT                  AND   V+21    : ANY BIT          LDX   #7                      ORA   B3IRQ
:      7:DELAY. 1ST NVNT
```

```
        STA     V+29                    STA     DLSTK2.X :2ND NVNT      STY     CUR1                    STA     LASTSN+8
IRQ200  LDA     (SFB).Y :EXPAND Y?      INY                            DINC    NUMR20                  LDA     #0
        AND     #64                     LDA     V+21     :TURN ON       LDY     CURSRT                  STA     CUR1
        BEQ     IRQ210                  ORA     #3IRQ    : SPRITE       INC     CURSRT                  STA     CUR2
        LDA     V+23     :YES?          STA     V+21                    CPY     #5                      STA     NUMR20
        ORA     #3IRQ                IRQ250  LSR   #3IRQ                BCC     IRQ310                  STA     NUMR20+1
        STA     V+23                    DEX              :NEXT SPRITE   LDY     #0                      STA     NUMR50
IRQ210  LDA     (SFB).Y :RIGHT X?       BEQ     IRQ250   :FINISHED?     STY     CURSRT                  STA     NUMR50+1
        AND     #32                     JMP     IRQ160               IRQ310  LDA   #1IRQ              IRQ350  PLA
        BEQ     IRQ220               IRQ250  TYA              :SET UP            STA   SRTBUF.Y                 STA   SFC
        LDA     V+16                    CLC              : TARORD       TYA                             PLA
        ORA     #3IRQ                   ADC     SFB      : FOR NEXT     CLC                             STA     SFB
        STA     V+15                    STA     TARORD   : TIME         ADC     #5                      JMP     SEL31   :NORMAL IRQ
IRQ220  LDA     (SFB).Y :SPR COLOR      LDA     SFC                     TAY                           AFTER   LDY   CUR2    :STACK PTR
        AND     #15                     ADC     #0                      LDA     #2IRQ                   INC     CUR2
        STA     V+39.X                  STA     TARORD+1                STA     SRTBUF.Y                LDA     53257   :X LOCATION
        INY                             LDA     IRQ2     :SHOW NUMBER   LDA     IRQ      :HAS TRIGGER   STA     #1IRQ
        LDA     (SFB).Y :TIME LIMIT     AND     #2       : OF TARGTS?   AND     #12      : BEEN        STA     YLPA60.Y
        CMP     #255     :NO LIMIT?     BEQ     IRQ270                  BNE     IRQ320   : RELEASED?    LDA     53258   :Y LOCATION
        BEQ     IRQ230                  JSR     SHONUM                  LDA     56321    :TRIGE PULL    STA     #2IRQ
        LSR     A        :TIME LIMIT  IRQ270  LDA   IRQ                 CMP     #247                    STA     YLPA60.Y
        LSR     A        : 2ND NVNT     BMI     BEFORE                  BNE     IRQ320                  LDA     V+15    :RIGHT X FOR
        LSR     A                       JMP     AFTER                   BIT     BOXCOL   :LIGHTPEN      ASL     A       : SPRITE 7
        AND     #254                  BEFORE  AND   #5       :READY TO  BPL     SWPULL   : ON SCREEN?   LDA     V+14    :XVAL: S7
        STA     TLIM2.X                 BEQ     IRQ290   : PROCESS?     LDA     #4                      ROR     A       : /2
        LDA     (SFB).Y :TIME LIMIT   IRQ280  JMP   IRQ360              STA     53280                   STA     XTGA60.Y
        AND     #15      : 1ST NVNT   IRQ290  JSR   ONSCRN            IRQ320  JMP   IRQ350              LDA     SORTAF
        ASL     A                       ABDR    SFB.XLPB20           SWPULL  JSR   BANG                 BEQ     IRQ380
IRQ230  STA     TLIM1.X                 LDA     CUR2                    LDA     #0       :IF ANYONE     LDY     CURSRT
        INY                             AND     #127                    STA     XVAL     : HAS THE      INC     CURSRT
        LDA     (SFB).Y :DELAY FOR      TAY                             STA     XVAL+1   : REVELATION   CPY     #5
        STA     DLSTK1.X : 1ST NVNT     LDA     SHOTS                   STA     YVAL     : THAT SORT-   BCC     IRQ370
        STA     CDLSTK.X                AND     #1                      STA     YVAL+1   : ING REALLY   LDY     #0
        INY                             BEQ     IRQ300                  LDA     #1IRQ    : IS THE       STY     CURSRT
        LDA     (SFB).Y :INCREMENT      TYA                             BEQ     IRQ340   : ANSWER.    IRQ370  LDA   #1IRQ
        STA     INSTK.X                 ORA     #128                    ASL     A        : REMOVE               STA   SRTBUF.Y
        INY                             TAY                             LDX     #0       : THESE                TYA
        LDA     (SFB).Y :FLIGHT TIME    INC     SFC                     BCC     IRQ330   : LINES AND            CLC
        LSR     A        : 2ND NVNT   IRQ300  LDA   #1IRQ               INX              : REINSERT             ADC   #5
        LSR     A                       STA     XLPB50.Y             IRQ330  CLC          : THE CALL            TAY
        LSR     A                       LDA     #2IRQ                   ADC     OFFX     : TO GETXY     LDA     #2IRQ
        LSR     A                       STA     YLPB60.Y                STA     XVAL     : IN CTRMOV    STA     SRTBUF.Y
        STA     TIMFL2.X                LDA     V+15     :RIGHT X FOR   TXA              : ---          DEC     SORTAF
        LDA     (SFB).Y :FLIGHT TIME    ASL     A        : SPRITE 7     ADC     OFFX+1   : ---        IRQ380  DEC   NUMRD   :# READINGS
        AND     #15      : 1ST NVNT     LDA     V+14     :XVAL: S7      STA     XVAL+1   : ---                  BNE   IRQ400  : TO TAKE
        STA     TIMFL1.X                ROR     A        : /2           LDA     #2IRQ    : ---                  LDA   IRQ
        INY                             STA     XTGB50.Y                CLC              : ---                  EOR   #192
        LDA     (SFB).Y :X DRIFT        INY                             ADC     OFFY     : ---                  STA   IRQ
        STA     XDRIFT.X                STY     CUR2                    STA     YVAL     : ---                  LDA   #0      :ZERO STACK
        INY                             DINC    NUMR60                IRQ340  LDA   IRQ                         STA   CUR1    :PTR IF DONE
        LDA     (SFB).Y                 DEC     #7IRQ                   AND     #127                            STA   CUR2
        STA     YDRIFT.X                BNE     IRQ280                  ORA     #76                             STA   CURSRT
        INY                             LDA     #3                      STA     IRQ                             LDA   #1
        LDA     (SFB).Y :SPECIAL        STA     #7IRQ                   LDA     #0       :FORMERLY 3            STA   #7IRQ
        STA     SPECIL.X                LDY     CUR1                    STA     SORTAF                          BIT   IRQ2
        AND     #16      :COUNT AS      LDA     #1IRQ                   LDA     #20                             BMI   IRQ390
        BNE     IRQ240   : TARPRE?      STA     (SFB).Y                 STA     NUMRD                           BVC   IRQ400
        INC     TARPRE                  INC     SFC                     JSR     INFOFB                          LDA   V+21
        TXA                             INC     SFC                     LDY     #5                              AND   #254
        JSR     INCNUM                  LDA     #2IRQ                   LDA     NUMR20                          BNE   IRQ400
        TAX                             STA     (SFB).Y                 STA     (SFB).Y               IRQ390  LDA   IRQ
IRQ240  INY                             INC     SFC                     STA     LASTSN.Y                        AND   #63
        LDA     (SFB).Y :CEN X OFFST    INC     SFC                     INY                                     STA   IRQ
        STA     CENX.X                  LDA     V+15     :RIGHT X FOR   LDA     NUMR20+1              IRQ400  JMP   IRQ350
        INY                             ASL     A        : SPRITE 7     STA     (SFB).Y               ONSCRN  LDA   53257   :X READINGS
        LDA     (SFB).Y :CEN Y OFFST    LDA     V+14     :XVAL: S7      STA     LASTSN.Y                        STA   #1IRQ
        STA     CENY.X                  ROR     A        : /2           LDA     NUMR60                          LDX   53258   :Y READINGS
        INY                             STA     (SFB).Y                 STA     LASTSN+7                        STX   #2IRQ
        LDA     (SFB).Y :DELAY FOR      INY                             LDA     NUMR50+1                        CMP   LPCMPX
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        BNE    ONSC30              ASL    A                   LDA    V+16            ROTATE LDA    1
        CPX    LPCHPY              ASL    A                   AND    #251                   PHA
        BNE    ONSC30              TAX                        STA    V+15                   LDA    #54
        BIT    BORCOL       SHN020 LDA    NUMDAT.X            JMP    RPL060                 STA    1
        BMI    ONSC20              STA    8255.Y       RPL050 LDA    V+16                   LDA    LASTSH+6
        INC    BORCOL              INX                        ORA    #4                     BEQ    ROT030
        LDA    BORCOL              INY                        STA    V+15                   LDY    LASTSH+5
        CMP    #30                 CPY    #16          RPL060 LDA    12928.Y :BULY          BEQ    ROT030
        BCS    ONSC10              BCC    SHN020             CLC                            ADDR   SFB.XLPB30
        RTS                        RTS                        ADC    OFFY                   ADDR   SFB.YLPB20
ONSC10  LDA    53280       NUMDAT .BYTE                       STA    H6IRQ                  LDY    #0
        ORA    #128        195.153.145.137.153.153.195.255.231.23     LDA    #0              LDA    SHOTS
        STA    BORCOL      1.199.231.231.231.129              LDA    12572.Y :BULX          AND    #1
:ONSC20 LDA    #0                 .BYTE                       ASL    A                      BEQ    ROT010
:       STA    H1IRQ       255.195.153.249.243.207.159.129.255.19     BCC    RPL070          INC    SFC
:       STA    H2IRQ       5.153.249.227.249.153              LDX    #1                     INC    SFE
ONSC20  RTS                       .BYTE               RPL070 CLC                     ROT010 LDA    (SFB).Y
ONSC30  STA    LPCHPX      195.255.249.241.225.153.128.249.249.25     ADC    OFFX           STA    HLDBUF.X
        STX    LPCHPY      5.129.159.131.249.249               STA    H4IRQ                 LDA    (SFD).Y
        BIT    BORCOL             .BYTE                        TAX                           STA    HLDBUF+255.X
        BPL    ONSC40      153.195.255.195.153.159.131.153.153.19     ADC    OFFX+1          INY
        LDA    BORCOL      5.255.129.153.243.231               STA    H5IRQ                 INX
        STA    53280              .BYTE                        LDA    H4IRQ                 BNE    ROT010
ONSC40  LDA    #0          231.231.231.255.195.153.153.195.153.15     CLC      :SPOST X     LDY    #0
        STA    BORCOL      3.195.255.195.153.153               SBC    #23     : OFFSET ROT020 LDA    HLDBUF.Y
        RTS                       .BYTE                        STA    V+2                    STA    (SFB).Y
INFOPB  LDA    #0          193.249.153.195.255.255.255.255.255.25     LDA    H5IRQ          LDA    HLDBUF+256.Y
        STA    SFC         5.255.255.255                       SBC    #0                     STA    (SFD).Y
        LDA    SHOTS             .END                          BNE    RPL080                 INY
        ASL    A                 .LIB   REPLAY                 LDA    V+16                   BNE    ROT020
        ASL    A           :REPLAY FOR ARM PROGRAM             AND    #253            ROT030 LDA    LASTSH+7
        ASL    A           :POKE H1IRQ & H2IRQ WITH PERFECT    STA    V+15                   ASL    A
        ROL    SFC         : SPOST X OFFSET (LOW/HIGH). POKE   JMP    RPL090                 BEQ    ROT050
        CLC                : H3IRQ WITH TARGET Y.       RPL080 LDA    V+16                   LDA    LASTSH+8
        ADC    #(INFO      REPLAY DEC    H7IRQ                 ORA    #2                     BNE    ROT040
        STA    SFB                BEQ    RPL010                STA    V+15                   BCC    ROT050
        LDA    SFC                JMP    SEA31  :NORMAL IRQ RPL090 LDA    H5IRQ   :BULY ROT040 ADDR   SFB.XLPB60
        ADC    #)INFO      RPL010 LDA    #3                    SEC                            JSR    ROTMOV
        STA    SFC                STA    H7IRQ                 SBC    #25     :SPOST Y        ADDR   SFB.YLPB60
        RTS                       LDY    CUR1                  STA    V+3     : OFFSET        JSR    ROTMOV
INCNUM  LDX    CURNUM+1            CPY    STOP   :LAST RDG?     INY                           ADDR   SFB.XTGB60
        INX                       BCC    RPL030                STY    CUR1                   JSR    ROTMOV
        CPX    #10                LDA    LASTSH :NO FIRE?       JMP    SEA31  :NORMAL IRQ ROT050 PLA
        BCC    INC020             CMP    #255          PUTTAR SEC                            STA    1
        LDX    CURNUM             BEQ    RPL020               ROL    A                       RTS
        INX                       JSR    BANG                  TAX                    ROTMOV LDX    #0
        CPX    #10                LDA    V+21   :TURN ON       BCC    RPL100                 LDA    LASTSH+7
        BCC    INC010             ORA    #1     : CROSS        LDA    V+16                   AND    #127
        LDX    #0                 STA    V+21                  ORA    #192                   TAY
INC010  STX    CURNUM      RPL020 LDA    #0                    STA    V+16                   LDA    SHOTS
        LDX    #0                 STA    IRQ2                  JMP    RPL110                 AND    #1
INC020  STX    CURNUM+1           JMP    SEA31          RPL100 LDA    V+16                   BEQ    ROTH10
        RTS                RPL030 LDA    13184.Y :BEFORE TPULL AND    #63                    LDA    SFB
SHONUM  LDY    #0                 JSR    PUTTAR                STA    V+15                   CLC
        LDX    #80    :LEAD SPACE LDA    METHEW :WAS IT A RPL110 STX    V+14   :X:SPRITE 7   ADC    #128
        LDA    CURNUM             CMP    #2     : TRAP?        LDA    LASTSH                 STA    SFB
        BEQ    SHN010             BEQ    RPL060                AND    #127                   LDA    SFC
        ASL    A                  LDX    #0     :PERFECT SP    CMP    #7                     ADC    #0
        ASL    A                  SEC                          BCC    RPL120                 STA    SFC
        ASL    A                  LDA    13184.Y               STX    V+12   :X:SPRITE 6 ROTH10 LDA    (SFB).Y
        TAX                       ROL    A              RPL120 RTS                           STA    HLDBUF.X
SHN010  LDA    NUMDAT.X           BCC    RPL040               .END                          INY
        STA    8256.Y             INX                 :                                      TYA
        INX                RPL040 CLC                 :PROCEDURE ROTATE                      AND    #127
        INY                       ADC    H1IRQ  :SP X OFF LOW :TAKES READINGS BEFORE TRIGGER TAY
        CPY    #8                 STA    V+4           :  PULL AND MOVES THEM SO THAT        INX
        BCC    SHN010             TAX                 :  THE OLDEST READINGS ARE FIRST.      BPL    ROTH10
        LDA    CURNUM+1           ADC    H2IRQ  :SP X OFF HI :C:STS ROTATE                   LDY    #0
        ASL    A                  BNE    RPL050        :A:RDGS IN BUFFERS ARE ADJUSTED. ROTH20 LDA    HLDBUF.Y
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        STA   (SFB).Y
        INY
        BPL   ROTK20
        RTS
NOTTRG LDA   56321    :REPEAT
        CMP   #255     : UNTIL
        BNE   NOTTRG   : TRIGGER IS
        RTS            : RELEASED
BANG    LDA   #15
        STA   54296
        LDA   #10
        STA   54277
        LDA   #30
        STA   54273
        LDA   #128
        STA   54276
        LDA   #129
        STA   54276
        RTS
WHISTL  LDY   #23
        LDA   #0
WHSL10  STA   SID.Y
        DEY
        BPL   WHSL10
        LDA   #18
        STA   DELAY
WHSL20  LDA   #180
        STA   SID+1
        LDA   #46
        STA   SID
        LDA   #15
        STA   SID+5
        STA   SID+24
        LDY   #7
WHSL30  LDX   #255
WHSL40  DEX
        BNE   WHSL40
        DEY
        BNE   WHSL30
        LDA   #170
        STA   SID+1
        LDA   #6
        STA   SID
        LDA   #21
        STA   SID+4
        LDY   #30
WHSL50  LDX   #255
WHSL60  DEX
        BNE   WHSL60
        DEY
        BNE   WHSL50
        DEC   DELAY
        BNE   WHSL20
        LDY   #23
        LDA   #0
WHSL70  STA   SID.Y
        DEY
        BPL   WHSL70
        RTS
;
;PROCEDURE WAIT
;CAUSES A DELAY
;B:LDY WITH AN APPROPRIATE DELAY
;C:JSR WAIT
;A:NONE
WAIT    LDX   #255
WAIT1   DEX
        BNE   WAIT1
        DEY

        BNE   WAIT1
        RTS
SCENE   LDA   SFB      :CEIP #/BLNK
        STA   SDFFF
        LDY   #0
        LDA   (SFD).Y
        STA   SFB      :CRUNCH CODE
        DINC  SFD
        LDA   #43
        STA   53265
        LDA   #29
        STA   53272
        ADDR  SA3.1024
SCL010  LDA   (SFD).Y
        STA   (SA3).Y
        DINC  SFD
        DINC  SA3
        LDA   SA3
        CMP   #<2024
        BNE   SCL010
        LDA   SA4
        CMP   #>2024
        BNE   SCL010
        ADDR  SA3.8192
SCL020  LDA   SFB      :CRUNCH CODE
        STA   (SA3).Y
        DINC  SA3
        LDA   SA3
        CMP   #<16192
        BNE   SCL020
        LDA   SA4
        CMP   #>16192
        BNE   SCL020
        ADDR  SA3.8192
SCL030  LDA   (SFD).Y
        CMP   SFB      :CRUNCH CODE
        BNE   SCL040
        DINC  SFD
        LDA   (SFD).Y
        STA   SA3
        DINC  SFD
        LDA   (SFD).Y
        CLC
        ADC   #>8192
        STA   SA4
        JMP   SCL050
SCL040  STA   (SA3).Y
        DINC  SA3
SCL050  DINC  SFD
        LDA   SA3
        CMP   #<16192
        BNE   SCL030
        LDA   SA4
        CMP   #>16192
        BNE   SCL030
        LDA   #59
        STA   53265
        LDA   #32     :RAM
        STA   SDFFF
        RTS
;PROCEDURE SEEVAL
;MOVE VALUES FROM UNDER ROM
; SINCE SHOTS WILL HAVE ALREADY
; BEEN INCREMENTED. THIS ROUTINE
; MOVES THE HIGH BUFFER IF SHOTS
; IS EVEN. IT MOVE THE LOW
; BUFFER IF SHOTS IS ODD
SEEVAL  LDA   1
        PHA

        LDA   #54      :SELECT RAM
        STA   1        : AT SA000
        ADDR  SFB.XLPB20
        LDY   #0
        LDA   SHOTS
        AND   #1
        BNE   SEE010
        INC   SFC
SEE010  LDA   (SFB).Y  :BULLET X
        STA   12672.Y
        INY
        BNE   SEE010
        INC   SFC
        INC   SFC
SEE020  LDA   (SFB).Y
        STA   12928.Y  :BULLET Y
        INY
        BNE   SEE020
        INC   SFC
        INC   SFC
SEE030  LDA   (SFB).Y  :TARGET X
        STA   13184.Y  : BEFORE
        INY
        BNE   SEE030
        LDY   #128
SEE040  LDA   XTGA60.Y :TARGET X
        STA   13440.Y  : AFTER
        DEY
        BPL   SEE040
        LDY   #32
SEE050  LDA   XLPA60.Y :BULLET X
        STA   13568.Y  : AFTER
        LDA   YLPA60.Y :BULLET Y
        STA   13600.Y  : AFTER
        DEY
        BPL   SEE050
        PLA
        STA   1
        RTS
;PROCEDURE COLORS
;CHANGES COLOR OF PART OF BITMAP
;POKE HOLD1 WITH START LINE
; POKE HOLD2 WITH # OF LINES
; POKE SFD WITH THE COLOR
COLORS  ADDR  SFB.1024
        LDX   HOLD1    :START LINE
        BEQ   COL020
COL010  JSR   ADD40
        DEX
        BNE   COL010
COL020  LDX   HOLD2    :HOW MANY
COL030  LDY   #39
COL040  LDA   SFD      :COLOR
        STA   (SFB).Y
        DEY
        BPL   COL040
        JSR   ADD40
        DEX
        BNE   COL030
        RTS
ADD40   LDA   SFB      :ADD 40 TO
        CLC            : SFB FOR
        ADC   #40      : NEXT LINE
        STA   SFB
        LDA   SFC
        ADC   #0
        STA   SFC
        RTS
;PROCEDURE HITHIS

;RETURNS HITS IN TEMP+TARGET #
; MISSES IN TEMP+64+TARGET #
; EXPOSURES IN TEMP+128+TARGET #
HITHIS  LDY   #192
        LDA   #0
HHL010  STA   TEMP-1.Y
        DEY
        BNE   HHL010
        LDA   SHOTS
        BEQ   HHL070
        STA   HOLD1
        LDA   1
        PHA
        LDA   #54
        STA   1
        ADDR  SFB.INFO
        LDY   #0
HHL020  LDA   (SFB).Y
        TAX
        AND   #127
        CMP   #7
        BCC   HHL030
        TXA
        AND   #248
        TAX
HHL030  TXA
        BMI   HHL040
        AND   #63
        TAX
        INC   TEMP.X
        JMP   HHL050
HHL040  CMP   #255
        BEQ   HHL060
        AND   #63
        TAX
        INC   TEMP+64.X
HHL050  INC   TEMP+128.X
HHL060  LDA   SFB
        CLC
        ADC   #8
        STA   SFB
        LDA   SFC
        ADC   #0
        STA   SFC
        DEC   HOLD1
        BNE   HHL020
        PLA
        STA   1
HHL070  RTS
        .LIB  MATHFUNCTIONS
;MATHFUNCTIONS FOR ARM PROGRAM
MATH    JSR   UNPLOT
        LDA   47
        STA   SFB
        LDA   48
        STA   SFC
MAT010  LDY   #0
        LDA   (SFB).Y
        BNE   MAT020
        RTS              :NO SE ARRAY
MAT020  CMP   #'S
        BNE   MAT030
        INY
        LDA   (SFB).Y
        CMP   #'B
        BEQ   MAT040
MAT030  INY              :ADD OFFSET
        LDA   (SFB).Y  : TO HIT
        CLC              : ARRAY
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        ADC    SFB        : (BYTES 2-       :                          STY    HOLD1            :NEXT LOCATION SCORE
        TAX               : 3) TO SFB       :LINING SCORE              STA    HOLD1+1          :
        INY                                 :                          JSR    FLOAT                   LDA    LASTSE
        LDA    (SFB).Y                      LDA    #128   :DOUBLE X     JSR    FAIFA2                  CMP    #255
        ADC    SFC                          STA    HOLD   : READING     LDY    HOLD1                   ...    MAT140
        STX    SFB                          JSR    NXITAR               LDA    HOLD1+1
        STA    SFC                          SEC                         JSR    FLOAT                   JSR    FLOAT
        JMP    MAT010                       SBC    SFB                  JSR    MLTPLY                  JMP    MAT150
MAT040  LDA    SFB    :ASSUME A             CLC                        JSR    FAIFA2           MAT140  JSR    NXITAR
        CLC           : 2-DIM'D             ADC    #1                   LDA    #<CONSQ                 JSR    RADEE2
        ADC    #9     : ARRAY               CMP    #2                   LDY    #>CONSQ          MAT150  LDX    HOLDAD
        STA    HOLDAD : WHERE 1ST           BCS    MAT090               JSR    MEMFA1                  LDY    HOLDAD+1
        LDA    SFC    : DIM HOLDS           LDA    #255                 JSR    MLTPLY                  JSR    FAIMEM
        ADC    #0     : EACH SCORE          TAY                         JSR    FAIFA2                  LDA    TEMF     :X AVG
        STA    HOLDAD+1                     JSR    FLOAT                LDA    HOLDAD                  LSR    TEMP+1
        LDX    #01    :SCORE #              JMP    MAT110               LDY    HOLDAD+1                EOR    A
        BEQ    MAT060               MAT090  STA    NSIZE                JSR    MEMFA1                  LDY    TEMP+2   :Y AVG
MAT050  LDA    HOLDAD :ASSUMING             JSR    AVG                  JSR    ADD                     JSR    FLOAT
        CLC           : 1ST DIM             TYA            :AVG X LOW   LDA    #02      :FIX SIGN       RTS
        ADC    #20    : IS 4.               CLC                        AND    #127     :ABS     NXITAR  LDA    HOLDAD   :SET UP
        STA    HOLDAD : ADDING 20           ADC    OFFX                 STA    #02      :ABS            CLC             : FOR NEXT
        LDA    HOLDAD+1 : (4*5) WILL        TAY                         JSR    SQRT                     ADC    #5       : ELEMENT
        ADC    #0     : BE THE              TXA            :AVG X HIGH  MAT110 LDX    HOLDAD            STA    HOLDAD   : IN ARRAY
        STA    HOLDAD+1 : NEXT SCORE        ADC    OFFX+1               LDY    HOLDAD+1                LDA    HOLDAD+1 : ---
        DEX                                 TAX                         JSR    FAIMEM                  ADC    #0       : ---
        BNE    MAT050                       TYA                         :                              STA    HOLDAD+1 : ---
:                                           CLC                        :TRIGGER SQUEEZE SCORE  NXA010  ADDR   SFD.XLPB50
:STEADY POSITION SCORE                      ADC    WDRIFT               :                              LDA    SHOTS    :WHICH
:                                           STA    TEMP                 JSR    NXITAR                  AND    #1       : LIGHTPEN
MAT060  LDA    #128   :DOUBLE X             TXA                         CMP    SFB                     BNE    NXA020   : BUFFER?
        STA    HOLD   : READING             ADC    WDRIFT+1             BNE    MAT120                  LDA    SFB
        JSR    NXA010                       STA    TEMP+1               LDA    #255                    CLC
        SEC                                 LDX    #0                   TAY                            ADC    #128
        SBC    SFB                          LDA    LASTSH+3 :TARGET X   JSR    FLOAT                   STA    SFB
        CLC                                 ASL    A                    JMP    MAT130                  LDA    SFE
        ADC    #1                           BCC    MAT100       MAT120  JSR    RANGE                   ADC    #0
        CMP    #2                           INX                         LDA    NSIZE                   STA    SFE
        BCS    MAT070               MAT100  SEC                         PHA                     NXA020  LDA    HOLDAD
        LDA    #255                         SBC    TEMP     :BULLET X   LDA    TIMES                   LDY    HOLDAD+1
        TAY                                 TAY                         PHA                            JSR    MEMFA1
        JSR    FLOAT                        TXA                         INC    SFE                     JSR    UNFLOT
        JMP    MAT080                       SBC    TEMP+1               LDA    #0       :NO DOUBLE      LDA    #00
MAT070  PHA                                 STY    HOLD1                STA    HOLD     : Y READING     STA    SFB
        JSR    STDEV                        STA    HOLD1+1              JSR    RANGE                   STA    NSIZE
        LDX    HOLDAD                       JSR    FLOAT                ADDR   SFD.YLPA60              LDA    #01
        LDY    HOLDAD+1                     JSR    FAIFA2               LDA    #0                      STA    SFC
        JSR    FAIMEM                       LDY    HOLD1                STA    SFB                     STA    TIMES
        INC    SFE                          LDA    HOLD1+1              LDA    #2                      RTS
        LDA    SFB                          JSR    FLOAT                STA    SFC             MUL2    LDX    #0
        STA    NSIZE                        JSR    MLTPLY               JSR    RAN010                  BIT    HOLE
        LDA    SFC                          LDX    HOLDAD               JSR    FAIFA2                  BPL    ML2010
        STA    TIMES                        LDY    HOLDAD+1             LDA    #<CONST                 ASL    A
        LDA    #0     :NO DOUBLE            JSR    FAIMEM               LDY    #>CONST                 BCC    ML2010
        STA    HOLD   : Y READING           INC    SFE                 JSR    MEMFA1                  INX
        PLA                                 LDA    #0       :NO DOUBLE  JSR    MLTPLY          ML2010  RTS
        JSR    STDEV                        STA    HOLD     : Y READING JSR    FAIFA2          :CONSTANTS (AND CONSTANTS SQUARED)
        JSR    FAIFA2                       JSR    AVG                  PLA                     :FOR SCALING THE Y COORDINATE
        LDA    #<CONST                      TYA                         STA    TIMES                  :(320/23.5)/(200/19.5)
        LDY    #>CONST                      CLC                         PLA                     :1.33 = 129.170.61.112.164
        JSR    MEMFA1                       ADC    OFFY                 STA    NSIZE           :1.75 = 129.225.71.174.20
        JSR    MLTPLY                       CLC                         LDA    #128     :DOUBLE X :320/200
        JSR    FAIFA2                       ADC    TRAJ                 STA    HOLD     : READING :1.6 = 129.76.204.204.205
        LDA    HOLDAD                       STA    TEMP+2               ADDR   SFD.XLPA60       :2.56 = 130.163.215.10.61
        LDY    HOLDAD+1                     LDA    LASTSH+4 :TARGET Y   JSR    RAN010          CONST   .BYTE 129.76.204.204.205
        JSR    MEMFA1                       SEC                         JSR    ADD             CONSQ   .BYTE 130.163.215.10.61
        JSR    ADD                          SBC    TEMP+2   :BULLET Y  MAT130 LDX    HOLDAD    ADJLOC  LDA    #71
MAT080  LDX    HOLDAD                       TAY                         LDY    HOLDAD+1                STA    HOLDAD
        LDY    HOLDAD+1                     LDA    #0                   JSR    FAIMEM                  LDA    #72
        JSR    FAIMEM                       SBC    #0                   :                              STA    HOLDAD+1
```

```
        LDA  1
        PHA
        LDA  #54
        STA  1
        LDY  #23
ADJ010  LDA  INFO.Y
        STA  TEMP.Y
        DEY
        BPL  ADJ010
        PLA
        STA  1
        LDX  #0
        STX  HOLDX
ADJ020  LDA  HOLDAD
        LDY  HOLDAD+1
        JSR  MEMFA1
        JSR  UNFLOT
        LDA  100   :X VALUE
        ASL  A
        LDY  #0
        BCC  ADJ030
        INY
ADJ030  CLC
        ADC  OFFX
        STA  LASTSH+1 :BULLET X
        TYA
        ADC  OFFX+1
        LSR  A
        ROR  LASTSH+1
        LDA  101   :Y VALUE
        CLC
        ADC  OFFY
        STA  LASTSH+2 :BULLET Y
        LDX  HOLDX
        LDA  TEMP+3.X
        STA  LASTSH+3
        LDA  TEMP+4.X
        STA  LASTSH+4
        JSR  RADERR
        LDX  HOLDAD
        LDY  HOLDAD+1
        JSR  FAIMEM
        LDA  HOLDAD  :SET UP
        CLC          : FOR
        ADC  #10     : SHOT LOC
        STA  HOLDAD  : SCORE
        LDA  HOLDAD+1
        ADC  #0
        STA  HOLDAD+1
        LDX  HOLDX
        LDA  TEMP+1.X :BULLET X
        ASL  A
        LDY  #0
        BCC  ADJ040
        INY
ADJ040  CLC
        ADC  OFFX
        STA  TEMP+1.X
        TYA
        ADC  OFFX+1
        LSR  A
        ROR  TEMP+1.X
        LDA  TEMP+1.X
        STA  INFO+1.X
        STA  INFO2+1.X
        STA  LASTSH+1
        LDA  TEMP+2.X :BULLET Y
        CLC
        ADC  OFFY
```

```
        STA  INFO+2.X
        STA  INFO2+2.X
        STA  LASTSH+2
        JSR  RADERR
        LDX  HOLDAD
        LDY  HOLDAD+1
        JSR  FAIMEM
        LDA  HOLDAD  :SET UP
        CLC          : FOR NEXT
        ADC  #10     : AIMING
        STA  HOLDAD  : SCORE
        LDA  HOLDAD+1
        ADC  #0
        STA  HOLDAD+1
        LDA  HOLDX
        CLC
        ADC  #8
        STA  HOLDX
        CMP  #24
        BCS  ADJ050
        JMP  ADJ020
ADJ050  RTS
STDEV   PHA
        LDA  #0
        TAY
        JSR  FLOAT
        JSR  FA15C
        LDA  #0
        STA  SUMX
        STA  SUMX+1
        STA  HOLD3
        STA  HOLD4
STDL10  LDA  1
        PHA
        LDA  #54
        STA  1
        LDY  TIMES
        LDA  (SFD).Y
        TAX
        BIT  HOLD4
        BMI  STDL20
        STA  HOLD3
        LDA  #128
        STA  HOLD4
        TXA
STDL20  CMP  HOLD3
        BEQ  STDL30
        LDA  HOLD4
        ORA  #54
        STA  HOLD4
        TXA
STDL30  JSR  MUL2
        STA  HOLD1
        STX  HOLD2
        CLC
        ADC  SUMX
        STA  SUMX
        LDA  SUMX+1
        ADC  HOLD2
        STA  SUMX+1
        PLA
        STA  1
        LDY  HOLD1
        LDA  HOLD2
        JSR  FLOAT
        JSR  FAIFA2
        LDY  HOLD1
        LDA  HOLD2
        JSR  FLOAT
```

```
        JSR  MLTPLY
        LDA  #55C
        LDY  #0
        JSR  MEMFA2
        JSR  ADD
        JSR  FA15C
        DEC  TIMES
        LDY  TIMES
        BMI  STDL40
        CPY  #SIZE
        BCS  STDL10
STDL40  PLA
        STA  #SIZE
        BIT  HOLD4
        BVS  STDL50
        LDA  #0
        TAY
        JSR  FLOAT
        RTS
STDL50  LDY  SUMX
        LDA  SUMX+1
        JSR  FLOAT
        JSR  FA1FA2
        LDY  SUMX
        LDA  SUMX+1
        JSR  FLOAT
        JSR  MLTPLY
        JSR  FA1FA2
        LDA  #0
        LDY  #SIZE
        JSR  FLOAT
        JSR  DIVIDE
        LDA  #55C
        LDY  #0
        JSR  MEMFA2
        JSR  SUBTRT
        JSR  FA1FA2
        LDA  #0
        LDY  #SIZE
        DEY
        JSR  FLOAT
        JSR  DIVIDE
        LDA  102   :FA1 SIGN
        AND  #127
        STA  102   :ABS
        JSR  SQRT
        RTS
AVG     LDA  #0
        STA  SUMX
        STA  SUMX+1
        STA  HOLD1
        STA  HOLD1+1
        LDA  1
        PHA
        LDA  #54
        STA  1
        LDY  SFC
AVG010  LDA  (SFD).Y
        JSR  MUL2
        CLC
        ADC  SUMX
        STA  SUMX
        TXA
        ADC  SUMX+1
        STA  SUMX+1
        DEY
        BMI  AVG020
        CPY  SFB
        BCS  AVG010
```

```
AVG020  PLA
        STA  1
AVG030  LDA  SUMX+1
        BNE  AVG040
        LDA  #SIZE
        CMP  SUMX
        BCC  AVG040
        BNE  AVG050
AVG040  LDA  SUMX
        SEC
        SBC  #SIZE
        STA  SUMX
        LDA  SUMX+1
        SBC  #0
        STA  SUMX+1
        DINC  HOLD!
        JMP  AVG030
AVG050  LDY  HOLE!
        LDX  HOLE1+1
        RTS
RANGE   LDA  #0
        STA  #SIZE
        LDA  #255
        STA  TIMES
RAN010  LDA  1
        PHA
        LDA  #54
        STA  1
        LDY  SFC
RAN020  LDA  (SFD).Y
        CMP  TIMES
        BCS  RAN030
        STA  TIMES
RAN030  CMP  #SIZE
        BCC  RAN040
        STA  #SIZE
RAN040  DEY
        BMI  RAN050
        CPY  SFB
        BCS  RAN020
RAN050  PLA
        STA  1
        LDA  #SIZE
        SEC
        SBC  TIMES
        JSR  MUL2
        TAY
        TXA
        JSR  FLOAT
        RTS
RADERR  LDX  #0
        LDA  LASTSH+1 :BULLET X
        ASL  A
        BCC  RAD010
        INX
RAD010  STA  CODE3
        STX  CODE4
        LDX  #0
        LDA  LASTSH+3 :TARGET X
        ASL  A
        BCC  RAD020
        INX
RAD020  SEC
        SBC  CODE3
        STA  CODE3
        TXA
        SBC  CODE4
        STA  CODE4
        LDY  CODE3
```

```
        JSR   FLOAT
        JSR   FA1FA2
        LDY   CODE3
        LDA   CODE4
        JSR   FLOAT
        JSR   MLTPLY
        JSR   FA15C
        LDX   #0
        LDA   LASTSH+2  ;BULLET Y
        SEC
        SBC   LASTSH+4  ;TARGET Y
        BCS   RAD030
        DEX
RAD030  STA   CODE3
        STX   CODE4
        LDY   CODE3
        LDA   CODE4
        JSR   FLOAT
        JSR   FA1FA2
        LDY   CODE3
        LDA   CODE4
        JSR   FLOAT
        JSR   MLTPLY
        JSR   FA1FA2
        LDA   #<CONSQ
        LDY   #>CONSQ
        JSR   MEMFA1
        JSR   MLTPLY
        LDA   #$5C
        LDY   #0
        JSR   MEMFA2
        JSR   ADD
        LDA   102      ;FA1 SIGN
        AND   #127
        STA   102      ;ABS
        JSR   SQRT
        RTS
TRKTMP  ADDR  SFD.XLPB60
        LDY   #0
        LDA   SHOTS
        AND   #1
        BNE   TRK010
        LDA   SFD
        CLC
        ADC   #128
        STA   SFD
        LDA   SFE
        ADC   #0
        STA   SFE
        LDY   #128
TRK010  LDA   #0
        STA   HOLD
        STY   TEMP+2
        JSR   UNPLOT
        LDA   100
        STA   SFB
        STA   NSIZE
        LDA   101
        STA   SFC
        STA   TIMES
        SEC
        SBC   SFB
        CLC
        ADC   #1-
        CMP   #2
        BCS   TRK020
        LDY   #2
        JMP   TRK060
TRK020  PHA
```

```
        JSR   GETSTD
        STX   TEMP
        STA   TEMP+1
        LDA   SFB
        STA   NSIZE
        LDA   SFC
        STA   TIMES
        LDA   1
        PHA
        LDA   #54
        STA   1
        LDY   TEMP+2
        LDX   #0
TRK030  LDA   XLPB60.Y  ;LPX=(LPX-
                        ;(TARX+CENX)
        SEC
        SBC   XTGB60.Y  ;+FINALTARX
        SEC
        SBC   CENX+7
        CLC
        ADC   LASTSH+3
        STA   XTGB60.X
        INY
        INX
        BPL   TRK030
        PLA
        STA   1
        ADDR  SFD.XTGB60
        PLA
        JSR   GETSTD
        LDY   #1
        CPX   TEMP
        BCC   TRK060
        BEQ   TRK040
        BCS   TRK050
TRK040  CMP   TEMP+1
        BCC   TRK060
TRK050  INY
TRK060  STY   METHEN
        CPY   #1
        BNE   TRK070
        JSR   SETTRK
        LDY   #1
TRK070  LDA   #0
        JSR   FLOAT
        RTS
SETTRK  LDA   1
        PHA
        LDA   #54
        STA   1
        LDX   #0
        LDY   #0
        LDA   SHOTS
        AND   #1
        BNE   STK010
        LDY   #128
STK010  LDA   XTGB60.X
        STA   XLPB60.Y
        INY
        INX
        BPL   STK010
        PLA
        STA   1
        RTS
GETSTD  JSR   STDEV
        JSR   FA1FA2
        LDY   #10
        LDA   #0
        JSR   FLOAT
        JSR   MLTPLY
```

```
        JSR   UNPLOT
        LDX   109
        LDA   101
        RTS
        .END
        .LIB  SHOTGROUPS
;PROCEDURE SHTGRP (SHOTGROUPS)
;POKE SFB WITH START ADDRESS.
; POKE X1.Y1 WITH TARGET CENTER
; POKE HOLD3.TARI
; POKE HOLD4.WITH # OF SHOTS.
; AT END: HITS. MISSES ARE SET.
; HOLD1 WILL HAVE # UNGRAPHABLE
; SHOTS. HOLD2 WILL HAVE TOTAL
; # SHOTS FIRED AT THIS TARGET
SHTGRP  LDA   X1
        CMP   #160
        BCC   SHT010
        BEQ   SHT020
        LDA   #84
        LDX   #156
        JMP   SHT030
SHT010  LDA   #4
        LDX   #76
        JMP   SHT030
SHT020  LDA   #4
        LDX   #155
SHT030  STA   NSIZE
        STX   NSIZE+1
        LDA   #255
        STA   CHOICE
        LDA   #0
        STA   HITS
        STA   MISSES
        STA   HOLD1
        STA   HOLD2
        STA   HOLDY
        LDA   HOLD3
        AND   #127
        TAX
        CMP   #7
        BCC   SHT040
        LSR   A
        LSR   A
        LSR   A
        CLC
        ADC   #6
SHT040  SEC
        SBC   #1
        ASL   A
        ASL   A
        ASL   A
        TAY
        LDA   EXPDAT+4.Y
        STA   CODE2
        STX   CODE1
        LDY   #100
        LDA   #255
SHT050  STA   TEMP.Y
        DEY
        BPL   SHT050
        LDA   1
        PHA
        LDA   #54
        STA   1
SHT060  LDY   #0
        LDA   (SFB).Y
        AND   #127
        CMP   CODE1
```

```
        BEQ   SHT070
        JMP   SET160
SHT070  INC   HOLD2
        LDA   (SFB).Y
        BMI   SHT080
        INC   HITS
        JMP   SHT090
SHT080  INC   MISSES
SHT090  LDY   #4
SHT100  LDA   (SFB).Y
        STA   LASTSH.Y
        DEY
        BPL   SHT100
        LDA   #0
        STA   YVAL
        STA   YVAL+1
        STA   YVAL
        STA   YVAL+1
        LDA   LASTSH+3  ;TARX
        LDX   #0
        ASL   A
        BCC   SHT110
        INX
SHT110  STA   SFD
        STX   SFE
        LDA   LASTSH+1  ;BULX
        LDX   #0
        ASL   A
        BCC   SHT120
        INX
SHT120  SEC
        SBC   SFD
        STA   SFD
        TXA
        SBC   SFE
        STA   SFE
        LDX   CODE2
SHT130  LDA   YVAL
        CLC
        ADC   SFD
        STA   YVAL
        LDA   YVAL+1
        ADC   SFE
        STA   YVAL+1
        DEX
        BNE   SHT130
        LDA   YVAL
        CLC
        ADC   X1
        STA   YVAL
        TAX
        LDA   YVAL+1
        ADC   #0
        STA   YVAL+1
        LSR   A
        TXA
        ROR   A
        CMP   NSIZE
        BCC   SHT150
        CMP   NSIZE+1
        BCS   SHT150
        LDY   HOLDY
        STA   TEMP.Y
        LDX   LASTSH+2  ;BULT
        SEC
        SBC   LASTSH+4  ;TART
        STA   SFD
        LDA   #0
        SBC   #0
```

```
        STA  SFE           SHT200 JSR  BITPLT              LDA  YVAL   :Y AND 7
        LDX  CODE2                DINC XVAL                AND  #7
SHT140 LDA  YVAL                  DEC  CODE3               TAY
        CLC                       BNE  SHT200              LDA  XVAL   :X AND 7
        ADC  SFD                  LDA  HOLDA               AND  #7
        STA  YVAL                 STA  XVAL                STA  SA3
        LDA  YVAL+1               LDA  HOLDY               LDA  #7
        ADC  SFE                  STA  XVAL+1              SEC
        STA  YVAL+1               INC  YVAL                SBC  SA3    :7-(X AND 7)
        DEX                       LDA  #3                  TAX
        BNE  SHT140               STA  CODE3               LDA  #1
        LDA  YVAL                 DEC  CODE4               CPX  #0
        CLC                       BNE  SHT200              BEQ  PL040
        ADC  T1                   INY               PL030  ASL  A      :2^(7-(X
        STA  YVAL                 INY                      DEX         : AND 7))
        TAX                       TYA                      BNE  PL030
        LDA  YVAL+1               TAX               PL040  BIT  CHOICE
        ADC  #0           SHT210 LDA  TEMP.X               BPL  PL050
        STA  YVAL+1               CMP  #255                ORA  (SFD).Y
        BNE  SHT150               BEQ  SHT180              JMP  PL060
        CPX  #176                 CMP  SFB          PL050  EOR  (SFD).Y
        BCS  SHT150               BNE  SHT220       PL060  STA  (SFD).Y
        CPX  #24                  LDA  TEMP+1.X            LDY  HOLDY
        BCC  SHT150               CMP  SFC                 RTS
        LDY  HOLDY                BNE  SHT220       EXPDAT .BYTE 39.48.33.2.1.11.0.0
        INY                       INC  TEMP.X       ;50 K (L)
        TXA                       INC  TEMP+1.X            .BYTE 41.48.74.4.2.0.0.0
        STA  TEMP.Y        SHT220 INX                ;100 K
        INY                       INX                      .BYTE 35.34.37.3.3.0.0.0
        STY  HOLDY                JMP  SHT210        ;150 K
        JMP  SHT150        SHT230 LDA  #(EXPTAB            .BYTE 36.46.58.4.4.0.0.0
SHT150 INC  HOLD1                 STA  SUBNO         ;200 K
SHT160 LDA  SFB                   JSR  SELSUB              .BYTE 37.57.77.5.5.0.0.0
        CLC                       RTS               ;250 K
        ADC  #8            ;                              .BYTE 38.69.99.6.6.0.0.0
        STA  SFB           BITPLT STY  HOLDY         ;300 K
        LDA  SFC                  LDA  #0                  .BYTE 47.24.20.2.1.12.0.0
        ADC  #0                   STA  SFD           ;50 K (B)
        STA  SFC                  STA  SFE                 .BYTE 46.24.25.2.1.0.0.0
        DEC  HOLD4                STA  SA4           ;75 K
        BEQ  SHT170               STA  YVAL+1              .BYTE 45.48.66.4.2.0.0.0
        JMP  SHT060               LDA  YVAL          ;125 K
SHT170 PLA                       AND  #248    :INT(Y/8)*320    .BYTE 44.46.54.4.4.0.0.0
        STA  1                   LDX  #3            ;185 K
        LDY  #0            PL010  ASL  1                   .BYTE 40.0.33.2.1.0.0.0
SHT180 LDX  #0                   ROL  SA4           ;50 K (R)
        LDA  TEMP.Y               DEX                      .BYTE 48.24.62.2.1.0.0.0
        CMP  #255                 BNE  PL010         ;60 K (T)
        BEQ  SHT230               STA  SA3                 .END
        STA  SFB                  LDX  #5                  .END
        ASL  1            PL020  LDA  SFD
        BCC  SHT190               CLC
        INX                       ADC  SA3
SHT190 SEC                        STA  SFD
        SBC  #1                   LDA  SFE
        STA  XVAL                 ADC  SA4
        STA  HOLDA                STA  SFE
        TXA                       DEX
        SBC  #0                   BNE  PL020
        STA  XVAL+1               LDA  XVAL    :8*INT(X/8)
        STA  HOLDX                AND  #248
        LDA  TEMP+1.Y             CLC
        STA  SFC                  ADC  SFD
        SEC                       STA  SFD
        SBC  #1                   LDA  XVAL+1
        STA  YVAL                 ADC  SFE
        LDA  #3                   CLC
        STA  CODE3                ADC  #>8192 ;+8192
        STA  CODE4                STA  SFE
```

```
        *=32768
:MLCH0BK1.TXT FOR ARM PROGRAM
        JMP   CTRMOV   :32768 (0)
        JMP   DESCRP   :32771 (3)
        JMP   RANDOM   :32774 (6)
        JMP   DODATA   :32777 (9)
        JMP   REKEEP   :32780 (12)
        JMP   YESNO    :32783 (15)
        JMP   GETXY    :32786 (18)
        JMP   RNDIZE   :32789 (21)
        JMP   EXPTAR   :32792 (24)
        JMP   CRITER   :32795 (27)
        JMP   YESNO2   :32798 (30)
        .LIB  MACROS-VARS
        .END
        .OPT  NOL
BANG   =3212
BITPLT =3245
DSABLE =3203
ENABLE =3200
NOTTRG =3209
ROTATE =3206
WAIT   =3218
WHISTL =3215
LETML  =49185
PRGNUM =49161
        .LIB  CTRMOV
:PROCEDURE CTRMOV
:POKE KEYMSK WITH THE CODE FOR
: KEYS TO PERMIT FROM THE MATRIX
: AT 56321. FOR EXAMPLE. 128
: ALLOWS BREAK. 4 ALLOWS CTRL.
: 132 ALLOWS BOTH. THE KEYS FROM
: BITS 0-7 ARE: 1..CTRL.2.SPACE.
: COMMODORE.Q.BREAK
CTRMOV JSR   ENABLE
        LDA   #0
        STA   HITSPR
        STA   NUMR20
        STA   NUMR20+1
        STA   NUMR60
        STA   NUMR60+1
        STA   FSTAT
        JSR   SB1BF
        LDA   101
        STA   IRQ
        LDA   100
        STA   IRQ2
CTR010 LDA   #0
        STA   OFFSCR
CTR020 JSR   MOVESP
        JSR   PAUSE
        BCS   CTR030
        JMP   CTR420
CTR030 LDA   SORTAF
        BNE   CTR030
;       JSR   GETXY   :NO MORE SORT
        JSR   CLOSES
        STA   CURTAR
        TAX
        BNE   CTR040
        JMP   CTR100
CTR040 LDA   SPECIL.X
        STA   SPECIL
        LDA   #0
        STA   WDRIFT+1
        LDA   WIND
        AND   #96
        BEQ   CTR060

        LDA   XDRIFT.X
        ASL   A
        ASL   A        :RANGE*8
        ASL   A
        ASL   A
        STA   XDRIFT
        LDA   WIND     :GET SPEED
        AND   #7
        CLC
        ADC   XDRIFT   : OFFSET
        TAY
        LDA   WIND     :FULL OR
        AND   #32      : HALF VALUE?
        BNE   CTR050
        LDA   WTABLE.Y
        LSR   A
        LSR   A
        LSR   A
        LSR   A
        JMP   CTR060
CTR050 LDA   WTABLE.Y
        AND   #15
CTR060 STA   WDRIFT
        BIT   WIND     :NEGATIVE
        BPL   CTR070   : DIRECTION?
        DEC   WDRIFT+1
        EOR   #255
        STA   WDRIFT
        DINC  WDRIFT
CTR070 LDA   WDRIFT.X
        STA   TRAJ
        LDA   TIMFL1.X
        BEQ   CTR100
        STA   CURTF
        LDA   DLSTK1.X
        BEQ   CTR100
        LDX   HOLD1
        LDA   V.X
CTR080 STA   HOLD2
        JSR   MOVESP
        JSR   PAU010
        LDA   OFFSCR
        BEQ   CTR090
        EOR   #255
        AND   V+21
        STA   V+21
        LDA   #0
        STA   OFFSCR
CTR090 LDA   V+21
        AND   HOLD3
        BEQ   CTR100
        LDX   HOLD1
        LDA   V.X
        CMP   HOLD2
        BEQ   CTR080
        DEC   CURTF
        BNE   CTR080
CTR100 LDA   IVAL
        CLC
        ADC   WDRIFT
        STA   IVAL
        STA   V
        LDA   IVAL+1
        ADC   WDRIFT+1
        STA   IVAL+1
        LDA   YVAL
        CLC
        ADC   TRAJ
        STA   YVAL
        STA   V+1

        LDA   V+16
        AND   #254
        LDX   IVAL+1
        BEQ   CTR110
        ORA   #1
CTR110 STA   V+16
        LDA   V+28     :TURN OFF
        AND   #254     : MULTICOLOR
        STA   V+28     : FOR SPR 0
        LDA   #34      :BULLET
        STA   2040
        LDA   #12      :MED GRAY
        STA   V+39
        LDA   #0
        STA   SSCOL
        LDA   IRQ2     :NO CHECK
        AND   #32      : FOR
        BNE   CTR140   : COLLISION?
        LDA   V+21     :TURN ON FOR
        ORA   #1       : COLLISION
        STA   V+21     : CHECK
        LDX   #2
CTR120 LDA   IRQ      :CHECK FOR
        ORA   #32      : COLLISION
        STA   IRQ
CTR130 LDA   IRQ
        AND   #32
        BNE   CTR130
        DEX
        BNE   CTR120
        LDA   V+21     :TURN OFF
        AND   #254     : BULLET
        STA   V+21
CTR140 LDA   #0
        STA   SFC
        LDA   SHOTS
        ASL   A
        ASL   A
        ASL   A
        ROL   SFC
        CLC
        ADC   #<INFO
        STA   SFB
        LDA   SFC
        ADC   #>INFO
        STA   SFC
        LDA   SSCOL
        AND   #254
        TAY
        LDA   #2
        STA   CODE3    :2 (HIT SPR)
        LDX   #1       :HIT SPR
CTR150 TYA
        STX   CODE2
        AND   CODE3
        CLC
        BNE   CTR160
        INX
        ASL   CODE3
        BCC   CTR150
        LDX   #0
        STX   CODE2
        LDX   CURTAR
CTR160 LDA   TARNUM.X
        BCC   CTR170
        ORA   #128
        JMP   CTR180
CTR170 INC   HITS
CTR180 LDY   #0

        STA   TARNUM
        STA   (SFB).Y :TARGET ID
        STA   LASTSE.Y
        INY
        LDA   IVAL+1
        LSR   A
        LDA   IVAL
        ROR   A
        STA   (SFB).Y :BULL/2
        STA   LASTSE.Y
        INY
        LDA   YVAL
        STA   (SFB).Y :BULY
        STA   LASTSE.Y
        INY
        LDA   SPECIL.X
        STA   SPECIL
        LDA   CENX.X
        STA   CENX
        LDA   CENY.X
        STA   CENY
        TXA
        ASL   A        :FOR SPR XY
        PHA
        LDA   V+16
CTR190 LSR   A        :PUT RIGHT
        DEX              : X IN
        BPL   CTR190   : CARRY
        PLA
        TAX
        LDA   V.X
        ROR   A        :RIGHT X
        CLC              :ADD CENTER X
        ADC   CENX     : OFFSET
        STA   (SFB).Y :TARX/2
        STA   LASTSE.Y
        INY
        LDA   V+1.X
        CLC              :ADD CENTER Y
        ADC   CENY     : OFFSET
        STA   (SFB).Y :TARY
        STA   LASTSE.Y
        LDA   IRQ2     :IS THIS SHOT
        AND   #4       : A REPEAT?
        BNE   CTR210
        LDA   SFB      :STORE IN
        CLC              : 2ND INFO
        ADC   #<344    : BUFFER
        STA   SFB      : (DISK
        LDA   SFC      : RECORDS
        ADC   #>344    : ONLY SAVE
        STA   SFC      : ORIGINAL
        LDA   SHOTS    : SHOT)
        CLC
        ADC   #1
        STA   SHOTAK
        LDY   #7
CTR200 LDA   LASTSE.Y
        STA   (SFB).Y
        DEY
        BPL   CTR200
CTR210 LDA   IRQ2     :NO CROSS?
        AND   #16
        BNE   CTR240
        LDA   IRQ2
        AND   #8
        BEQ   CTR220
        LDA   LASTSE
        BPL   CTR240
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CTR220 LDA  XVAL     :PUT UP CROSS        CPX  #128                        LDA  #13                      LDA  DLSTE1.X :STATIONARY?
       SEC                                BCC  CTR310               CTR419 STA  1972.Y                    BEQ  MOV060
       SBC  #10                           JMP  CTR320                      DEY                           DEC  CDLSTK.X :MOVE ???
       STA  V                      CTR300 LDA  IRQ2    :SPECIAL             BPL  CTR410                   BNE  MOV050
       LDA  XVAL+1                        AND  #8      : CROSS?             JMP  CTR020                   LDA  HOLD
       SBC  #0                            BEQ  CTR330               CTR420 LDA  IRQ                       AND  OFFSCR
       TAX                                CPX  #128    :MISS?              AND  #192                     BNE  MOV060
       LDA  V+16                          BCS  CTR330                      BEQ  CTR470                   LDA  DLSTE1.X
       AND  #254                   CTR310 LDA  CODE3   :TURN OFF           LDA  56321                    STA  CDLSTK.X
       CPX  #0                            EOR  #255    : HIT TARGET         EOR  #255                     LDA  HOLD    :CHECK
       BEQ  CTR230                        AND  V+21    : NOW                AND  KEYMSK                   AND  V+15    : RIGHT X
       ORA  #1                            STA  V+21                        BEQ  CTR430                   BEQ  MOV020
CTR230 STA  V+16                   CTR320 LDA  #0                          STA  FSTAT   :KEY FLAG        LDA  #1
       LDA  YVAL                          STA  HITSPR                      JMP  CTR470            MOV020 STA  HOLDX
       SEC                                JMP  CTR350               CTR430 LDA  OFFSC2                    LDA  INSTK.X :ADD
       SBC  #9                     CTR330 LDA  CODE3   :SET UP TO          BNE  CTR440                   STA  HOLDY   : INCREMENT
       STA  V+1                           ORA  #1      : TURN OFF          JMP  CTR020                   CLC
       LDA  #42                           STA  HITSPR  : HIT TARGET CTR440 AND  #1      :WHISTLE         ADC  V.Y
       STA  2040                          LDX  #7      :STOP HIT           BEQ  CTR450  : FLAG           STA  V.Y
       LDA  V+28    :MULTICOLOR           LDA  #128    : TARGET            LDA  V+21    :SPRITE ON?      LDA  #0
       ORA  #1      : MODE ON             STA  CODE1                       AND  #254                     BIT  HOLDY   :INCREMENT<0?
       STA  V+28                   CTR340 LDA  CODE3                       BEQ  CTR450                   BPL  MOV030
       LDA  #1      :WHITE                AND  CODE1                       JSR  WHISTL                   LDA  #255
       STA  V+39                          BEQ  CTR350               CTR450 LDA  OFFSCR  :CLEAR FLAG MOV030 ADC  HOLDX
       LDA  V+21                          LDX  #0                          AND  #254                     BEQ  MOV040
       ORA  #1                            STA  INSTK.X                     STA  OFFSCR                   LDA  HOLD
       STA  V+21                   CTR350 LSR  CODE1                CTR450 LDA  OFFSCR                    ORA  V+16
CTR240 LDA  SSCOL   :WAS CLOSEST          DEX                              EOR  #255                     STA  V+16
       AND  HOLD3   : TARGET HIT?         BNE  CTR340                      AND  V+21                     LDA  V.Y
       BNE  CTR250  :YES                  LDA  #30                         STA  V+21                     CMP  #80
       LDX  CURTAR                        STA  CRSDLA                      CLC                           BCS  MOV050
       BEQ  CTR250                 CTR360 BIT  TARNUM                      JSR  CKSPCL                    JMP  MOV060
       LDA  SPECIAL.X                     BVS  CTR390                      BCS  CTR470            MOV040 LDA  HOLD
       AND  #64     ;REVERSE              LDX  #7      :CHECK FOR          JMP  CTR010                   EOR  #255
       BEQ  CTR250  : DIRECTION?          LDA  #128    : PENALTIES  CTR470 LDA  IRQ                       AND  V+15
       LDA  INSTK.X                       STA  CODE1                       AND  #15                      STA  V+15
       EOR  #255                   CTR370 LDA  V+21    :SPRITE MUST        STA  IRQ                      LDA  V.Y
       CLC                                AND  CODE1   : BE ON             MOVE SPB.TARORD               CMP  #20
       ADC  #1                            BEQ  CTR380                      LDY  #0                       BCS  MOV060
       STA  INSTK.X                       LDA  TARNUM  :HIT TARGET         LDA  (SFB).Y           MOV050 LDA  HOLD
CTR250 LDA  SPECIL                        AND  #127                        CMP  #254                     ORA  OFFSCR
       BPL  CTR260                        CMP  TARNUM.X                    BNE  CTR480                   STA  OFFSCR
       JMP  CTR350                        BCC  CTR380  :MUST BE LESS       DINC TARORD            MOV060 DEY
CTR260 AND  #32     :IS THIS              BEQ  CTR380  : OR EQUAL   CTR480 LDA  #0                       DEY
       BEQ  CTR290  : TARGET MORE         INC  PENAL                       LDY  FSTAT                    LSR  HOLD
       LDA  #128    : THAN 1 SPR?         JMP  CTR390                      JSR  SB391                    DEX
       STA  CODE1                  CTR380 LSR  CODE1                       RTS                           BNE  MOV010
       LDX  #7                            DEX                       CKSPCL LDA  IRQ2    :RETURN WHEN      RTS
CTR270 LDA  V+21                          BPL  CTR370                      BMI  CKSP10  : NO TARGETS PAUSE LDA  IRQ    :TRIG PULL
       AND  CODE1                  CTR390 JSR  ROTATE                      AND  #64     : UP?            AND  #4
       BEQ  CTR280                        INC  SHOTS                       BEQ  CKSP40                   BEQ  PAU010
       LDA  TARNUM.X                      LDA  IRQ                         LDA  V+21                     SEC
       CMP  TARNUM                        AND  #251                        AND  #254                     RTS
       BNE  CTR280                        STA  IRQ                         BNE  CKSP40            PAU010 LDA  #S66
       LDA  CODE1                         SEC                       CKSP10 BCC  CKSP30           PAU020 SEC
       ORA  CODE3                         JSR  CKSPCL               CKSP20 LDA  IRQ                       SBC  #1
       STA  CODE3                         BCS  CTR470                      AND  #192                     BNE  PAU020
CTR280 LSR  CODE1                         LDA  SHOTS                       BNE  CKSP20                   CLC
       DEX                                CMP  MAXSHT               CKSP30 SEC                           RTS
       BNE  CTR270                        BCC  CTR420               CKSP40 CLC                    CLOSES LDA  #255
CTR290 LDA  HITSPR  :TURN OFF ANY         LDA  IRQ                         RTS                           STA  HOLDX   :LOW DISTANCE
       EOR  #255    : TARGET PRE-         ORA  #1                   MOVESP LDY  #14                       LDA  #128
       ORA  #1      : VIOUSLY HIT         STA  IRQ                          LDX  #7                       STA  CODE1   :SPRITE CODE
       AND  V+21                          LDY  #87                         LDA  #128                     STA  TARNUM  : FOR MISS
       STA  V+21                   CTR400 LDA  MOAMMO.Y                     STA  HOLD                     LDA  XVAL+1
       LDX  LASTSH                        STA  15776.Y              MOV010 LDA  V+21                      LSR  A
       LDA  IRQ2                          DEY                              AND  HOLD                     LDA  XVAL
       AND  #16                           BPL  CTR400                      BEQ  MOV050                   ROR  A
       BEQ  CTR300                        LDY  #10                                                       STA  HOLDX   :BULLET X
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        LDA   #0                    .OPT  NOL                    INY                      .BYTE  23.121.  9. 48.235.  5.
        STA   HOLD1                 .LIB  DATAITEMS       RAN070 LDX   #15             41.254.  1.  6.254. 48. 12. 61.  0.254
        STA   HOLD3          ;DATAITEMS FOR ARM PROGRAM  RAN080 LDA   (SFB).Y             .BYTE 2. 23.163. 11. 47.235.  5.
        LDX   #14            DODATA JSR   WECDAT                 STA   (SFD).Y          21.254.  3.  6.254. 32. 12. 19.  0
CLO010  LDA   V+21   :SPRITE ON?    LDA   #<DITEMS               INY                      .BYTE  23.121. 11. 48.235.  5.
        AND   CODE1                 CLC                          DEX                   21.254.  3.  6.254. 48. 12. 61.  0.254
        BEQ   CLO050                ADC   STOP                   BNE   RAN080              .BYTE 2. 23.163. 13. 47.235.  5.
        LDA   V+1.X                 STA   STOP                   DEC   SA3              10.254.  5.  6.254. 32. 12. 19.  0
        SEC                         LDA   #>DITEMS               BNE   RAN070              .BYTE  23.121. 13. 48.235.  5.
        SBC   YVAL                  ADC   STOP+1                 LDA   (SFB).Y          10.254.  5.  6.254. 48. 12. 61.  0.254
        BCS   CLO020                STA   STOP+1                 BPL   RAN090              .BYTE 1.179.159. 17. 45.204.  5.
        EOR   #255                  ADDR  SFD.RANTAR             STA   (SFD).Y          52.254.  1.  7.254.  0. 12. 19.  0.254
        CLC                         LDY   #0                     INY                      .BYTE 1. 13.159. 19. 46.235.  5.
        ADC   #1             DOD010 LDA   (SFB).Y         RAN090 TYA                   26.254.  3.  7.254.  0. 12. 19.  0.254
CLO020  STA   HOLDY  :TART-BULY     STA   (SFD).Y                CLC                      .BYTE 1. 13.159. 21. 46.235.  5.
        LDA   V+16                  DINC  SFB                    ADC   SFD              13.254.  5.  7.254.  0. 12. 19.  0.254
        AND   CODE1                 DINC  SFD                    STA   SFD                 .BYTE 1.155.147. 25. 45.204.  5.
        CLC                         LDA   SFB                    LDA   SFE              86.254.  1.  8.254.  0. 12. 32.  0.254
        BEQ   CLO030                CMP   STOP                   ADC   #0                  .BYTE 1.  9.147. 27. 45.235.  5.
        SEC                         BCC   DOD010                 STA   SFE              43.254.  3.  8.254.  0. 12. 32.  0.254
CLO030  LDA   V.X                   LDA   SFC                    LDX   SA4                 .BYTE 1. 13.147. 29. 45.235.  5.
        ROR   A                     CMP   STOP+1                 RTS                   21.254.  5.  8.254.  0. 12. 32.  0.254
        SEC                         BCC   DOD010          WECDAT LDA   #<DITEMS            .BYTE 1.127.155. 33. 44. 12.
        SBC   HOLDX                 RTS                          CLC                   5.128.254.  1.  9.255.  0.  5. 13.
        BCS   CLO040         ;PROCEDURE RANDOM                   ADC   HOLD1          0.254
        EOR   #255           ;POKE STOP WITH THE STARTING LOC    STA   SFB                .BYTE 1.199.155. 35. 44. 12.  5.
        CLC                  ; IN STACK (X=START-16325)          LDA   #>DITEMS       54.254.  3.  9.255.  0.  5. 13.  0.254
        ADC   #1             ; AND 16325-XXXXX WITH THE DATA     ADC   HOLD1+1            .BYTE 1. 13.155. 37. 44. 44.  5.
CLO040  CLC                  ; ITEMS.  POKE HOLD1.HOLD2 WITH     STA   SFC            32.254.  5.  9.255.  0.  5. 13.  0.254
        ADC   HOLDY  :XDIF+YDIF     ; ADDRESS OFFSET OF DATA TO BE      RTS           :STATIONARY TARGETS FOR LEVEL 7
        ROR   A      :(XDIF+YDIF)/2 ; MOVED.                 ;ZERO DATA (0-17)            .BYTE 2.  0.165.  1. 39.204.  2.  0
        CMP   HOLDA          RANDOM LDX   STOP            DITEMS .BYTE                  0.  0.  0.255. 32. 24. 34.  0
        BCS   CLO050                ADDR  SFD.RANTAR      1.0.150.5.37.12.255.0.0.0.4.0.0.6.15.0   .BYTE   0.165.  1. 40.204.  2.  0
        STA   HOLDA          RAN010 JSR   WECDAT          .254.255                     0.  0.  0.255. 48.  0. 34.  0.254
        STX   HOLD1                 LDA   16325.X         :LEV 1-6 (18-515). LEV 7 (18-533)   .BYTE 1.  0.153.  2. 41.204.  3.  0
        LDA   CODE1                 BNE   RAN020              .BYTE 2. 41.153.  8. 47.204.  5.   0.  0.  1.254.  0. 12. 37.  0.254
        STA   HOLD3                 JSR   SEARCH          41.  2.  1.  6.254. 32. 12. 19.  0      .BYTE 1.  0.162.  3. 35. 12.  3.  0
CLO050  LSR   CODE1                 INX                      .BYTE  41.131.  8. 48.204.  5.   0.  0.  2.254.  0.  6. 13.  0.254
        DEX                         BNE   RAN010          41.  2.  1.  6.254. 48. 12. 61.  0.254   .BYTE 1.  0.150.  4. 36. 12.  4.  0
        DEX                  RAN020 LDY   #0                  .BYTE 2. 41.163. 10. 47.204.  5.   0.  0.  3.255.  0.  6. 15.  0.254
        BNE   CLO010                LDA   #255            21.  2.  3.  6.254. 32. 12. 19.  0      .BYTE 1.  0.138.  5. 37. 12.  5.  0
        LDA   HOLD1                 STA   (SFD).Y             .BYTE  41.121. 10. 48.204.  5.   9.  0.  4.  0.  0.  5. 15.  0.254
        LSR   A                     RTS                   21.  2.  3.  6.254. 48. 12. 61.  0.254   .BYTE 1.  0.126.  6. 38. 12.  5.  0
        RTS                  SEARCH STA   SA3                 .BYTE 2. 41.163. 12. 47.204.  5.   0.  0.  5.  1.  0.  5. 16.  0.254
VTABLE  .BYTE 0.16.17.33.49.66.66.0 STX   SA4             10.  2.  5.  6.254. 32. 12. 19.  0      .BYTE 255 (END LEVEL 7)
        .BYTE 0.17.33.50.66.83.115.0       LDY   #0             .BYTE  41.121. 12. 48.204.  5.   :LEVEL 8 (634-1197)
        .BYTE 0.17.49.66.99.116.148.0      LDX   #0        10.  2.  5.  6.254. 48. 12. 61.  0.254      .BYTE 144
        .BYTE 0.33.66.83.116.148.181.0     CMP   #0             .BYTE 1.141.159. 16. 46.204.  5.      .BYTE 1. 77.152. 36. 44. 12.  5. 32
        .BYTE 0.33.66.99.148.181.215.0     BEQ   RAN060    52.  2.  1.  7.254.  0. 12. 24.  0.254   2.  5. 10.255.  0.  5. 13.  0.138
        .BYTE 0.49.83.132.181.231.248.0 RAN030 LDA  (SFB).Y     .BYTE 1. 51.159. 18. 46.204.  5.      .BYTE 135 (END 1)
        .BYTE 0.16.33.33.50.66.82.0        DINC  SFB       26.  2.  3.  7.254.  0. 12. 24.  0.254      .BYTE 3.251.115.  6. 38. 12.  4.  0
        .BYTE 0.16.17.33.49.66.66.0        TAX                  .BYTE 1. 31.159. 20. 46.204.  5.   0.  0.  5.  1.  0.  5. 16.  0
        .BYTE 0.17.49.66.83.115.132.0 RAN040 LDA  SFB       13.  2.  5.  7.254.  0. 12. 24.  0.254      .BYTE  83.130.  5. 37. 12.  3.  0
        .BYTE 0.33.50.82.115.132.165.0     CLC                  .BYTE 1.155.147. 24. 45.204.  5.   0.  0.  5.  0.  0.  5. 15.  0
NOANNO  .BYTE                       ADC   #15             86.  2.  1.  8.254.  0. 12. 32.  0.254      .BYTE 225.152. 35. 44. 12.  5.
60.102.102.102.102.102.60.0.102.102.10     STA   SFB            .BYTE 1. 55.147. 26. 45.204.  5.   54.254.  3. 10.255.  0.  5. 13.  0.140
2.102.102.102.60.0.126             LDA   SFC               43.  2.  3.  8.254.  0. 12. 32.  0.254      .BYTE 135 (END 2)
        .BYTE                       ADC   #0                   .BYTE 1. 51.147. 28. 45.204.  5.      .BYTE 2.121.145.  4. 36. 12.  4.  0
24.24.24.24.24.24.0.0.0.0.0.0.0.0.60       STA   SFC       21.  2.  5.  8.254.  0. 12. 32.  0.254   0.  0.  4.255.  0.  6. 15.  0
.102.102.102.102.102               DEX                      .BYTE 1.193.155. 32. 44. 12.      .BYTE 251.145.  4. 36. 12.  4.  0
        .BYTE                       BNE   RAN040          5.128.  2.  1.  9.255.  0.  6. 13.   0.  0.  4.255.  0.  6. 15.  0.132
60.0.126.96.96.120.96.96.96.0.0.0.0.0.     LDA   (SFB).Y   0.254                           .BYTE 1.109.152. 33. 44. 12.
0.0.0.0.24.60.102.126              BPL   RAN050                .BYTE 1.121.155. 34. 44. 12.  5.   4.128.254.  1. 10.255.  0.  5. 13.
        .BYTE                       DINC  SFB             64.  2.  3.  9.255.  0.  6. 13.  0.254   0.136
102.102.102.0.99.119.127.107.99.99.99.  RAN050 DEC   SA3       .BYTE 1. 51.155. 35. 44. 12.  5.      .BYTE 1.251.115.  6. 38. 12.  4.
0.99.119.127.107.99.99             BNE   RAN030          32.  2.  5.  9.255.  0.  6. 13.  0.254   0.  0.  6.  1.  0.  5. 16.  0.136
        .BYTE               RAN060 LDA   (SFB).Y         :RIGHT TO LEFT BEGINS HERE              .BYTE 145 (END 3)
99.0.60.102.102.102.102.102.60.0          STA   SA3            .BYTE 2. 23.163.  9. 47.236.  5.      .BYTE 1. 79.160.  3. 35. 12.  4.
        .END                        STA   (SFD).Y         41.254.  1.  6.254. 32. 12. 19.  0   0.  0.  3.254.  0.  6. 13.  0.132
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     .BYTE 1.223.154.  2. 41.294.  4.         .BYTE 1. 33.161. 21. 46.236.  3.     10.254.  5.  6.254. 32. 12. 19.  0     21.254.  5.  9.254.  0. 12. 32.  0.134
0.  0.  0.  2.254.  0. 12. 37.  0.136    13.254.  5.  7.254.  0. 12. 24.  0.140     .BYTE    27.128. 13. 48.236.  3.       .BYTE 1. 57.151. 18. 45.204.  4. 26.
     .BYTE 2. 73.146. 28. 45.204.  3.         .BYTE 1. 55.146. 26. 45.204.  4.    13.254.  5.  6.254. 48. 12. 61.  0.149   2.  3.  8.254.  0. 12. 24.  0.136
21.  2.  1.  9.254.  0. 12. 32.  0       43.  2.  3.  8.254.  0. 12. 32.  0.142     .BYTE 1. 33.161. 21. 46.236.  3.       .BYTE 1. 35.146. 29. 45.236.  3.
     .BYTE    73.146. 24. 45.204.  5.         .BYTE 2. 31.161. 20. 46.204.  3.    13.254.  5.  7.254.  0. 12. 24.  0.140   21.254.  5.  9.254.  0. 12. 32.  0.132
86.  2.  1.  9.254.  0. 12. 32.  0.140    13.  2.  5.  7.254.  9. 12. 24.  0        .BYTE 2. 43.170. 12. 47.294.  3.       .BYTE 1.185.160.  3. 35. 12.  3.  9.
     .BYTE 1.165.152. 35. 44. 12.  4.         .BYTE    71.154.  2. 41.204.  7.    10.  2.  5.  6.254. 32. 12. 19.  0     9.  0.  3.254.  0.  6. 13.  0.134
64.254.  3. 10.255.  0.  6. 13.  0.136    0.  0.  0.  1.254.  0. 12. 36.  0.148     .BYTE    43.128. 12. 48.204.  3.       .BYTE 135 (END 4)
     .BYTE 1. 31.146. 28. 45.204.  4.         .BYTE 2. 23.170. 13. 47.235.  3.    10.  2.  5.  6.254. 48. 12. 61.  0.140     .BYTE 1.227.146. 24. 45.204.  3. 85.
21.  2.  5.  9.254.  0. 12. 32.  0.136    10.254.  5.  6.254. 32. 12. 19.  0        .BYTE 1. 55.146. 26. 45.204.  4.     2.  1.  9.254.  0. 12. 32.  0.130
     .BYTE 139 (END 4)                         .BYTE    23.128. 13. 48.236.  3.    43.  2.  3.  8.254.  0. 12. 32.  0.142     .BYTE 1.187.146. 27. 45.294.  3.
     .BYTE 1. 75.161. 19. 46.236.  4.         10.254.  5.  6.254. 48. 12. 61.  0.140 .BYTE 2.127.152. 33. 44. 12.       43.254.  3.  9.254.  0. 12. 32.  0.134
26.254.  3.  8.254.  0. 12. 24.  0.136         .BYTE 1. 31.161. 20. 46.204.  3.    5.128.254.  1.  9.255.  0.  6. 13.  0     .BYTE 1. 85.145.  4. 36. 12.  2.  0.
     .BYTE 2. 31.170. 10. 47.204.  4.    13.  2.  5.  7.254.  0. 12. 24.  0.140     .BYTE    23.115.  5. 38. 44.  7.     0.  0.  4.255.  0.  6. 15.  0.136
21.  2.  3.  7.254. 32. 12. 19.  0         .BYTE 1. 57.146. 26. 45.204.  4.     0.  0.  0.  5.  1.  0.  6. 15.  0.148     .BYTE 1. 27.152. 33. 44. 44.
     .BYTE    31.128. 10. 48.204.  4.    43.  2.  3.  8.254.  0. 12. 32.  0.142     .BYTE 1. 71.145.  4. 36. 12.  5.     50.128.254. 81. 10.255.  0.  6. 13.
21.  2.  3.  7.254. 48. 12. 61.  0.136        .BYTE 2. 27.170. 13. 47.236.  3.    0.  0.  0.  3.255.  0.  6. 14.  0.14     32.138
     .BYTE 1. 75.161. 19. 46.236.  4.    10.254.  5.  6.254. 32. 12. 19.            .BYTE 255 (END LEVEL 9)                 .BYTE 1.173.130.  5. 37. 12.  2.  0.
26.254.  3.  8.254.  0. 12. 24.  0.136         .BYTE    27.128. 13. 48.236.  ..   :LEVEL 10 (2010-2572)                0.  9.  5.  0.  0.  6. 15.  0.132
     .BYTE 2. 49.161. 18. 46.204.  4.    10.254.  5.  6.254. 48. 12. 61.  0.140     .BYTE 1.175.145.  4. 36. 12.  3.       .BYTE 1. 99.152. 36. 44. 12. 50. 32.
26.  2.  3.  8.254.  0. 12. 24.  0         .BYTE 2. 43.170. 12. 47.204.  3.    0.  0.  0.  4.255.  0.  6. 15.  0.136   2. 21. 10.255.  0.  6. 13.128.138
     .BYTE    75.170. 11. 47.236.  4.    10.  2.  5.  6.254. 32. 12. 19.  0         .BYTE 2. 55.152. 37. 44. 44. 82.       .BYTE 1.111.115.  6. 38. 12.  3.  9.
21.254.  3.  7.254. 32. 12. 19.  0             .BYTE    43.128. 12. 48.204.  3.   0.254. 80. 10.255.  0.  6. 13. 32     0.  0.  5.  1.  0.  5. 16.  0.135
     .BYTE    75.178. 11. 48.236.  4.    10.  2.  5.  6.254. 48. 12. 61.  0.140     .BYTE    155.160.  3. 35. 12.  3.       .BYTE 255 (END 5. END LEVEL 10)
21.254.  3.  7.254. 48. 12. 61.  0.136         .BYTE 2. 33.161. 21. 46.236.  3.   0.  0.  0.  3.254.  0.  6. 13.  0.142   :OLD LEVEL 6 (634-1215)
     .BYTE 133 (END 5)                    13.254.  5.  7.254.  0. 12. 24.  0         .BYTE 2. 35.146. 29. 45.236. 50.    :  .BYTE 1. 87.115.  6. 38. 12.  7.  0
     .BYTE 3. 89.154.  2. 41.204.  4.         .BYTE     7.160.  3. 35. 44.  7.    0.254. 80.  9.254.  0. 12. 32. 21     0.  9.  6.  1.  0.  6. 15.  0.132
0.  0.  3.  2.254.  0. 12. 37.  0             0.  0.  0.  2.254.  0.  6. 12.  0.148  .BYTE    135.154.  2. 41.204.  2.    :  .BYTE 1.251.115.  5. 38. 12.  5.  0.
     .BYTE    205.169.  1. 39.204.  4,         .BYTE 1. 89.154.  2. 41.204.  5.   0.  0.  0.  2.254.  9. 12. 37.  0.138  0.  0.  6.  1.  0.  6. 15.  0.138
0.  0.  0.  1.255. 32. 24. 34.  0        0.  0.  0.  1.254.  0. 12. 36.  0.144     .BYTE 1. 89.146. 26. 45.204.  5.    :  .BYTE 133 (END 1)
     .BYTE    253.169.  1. 40.204.  4,         .BYTE 3. 33.161. 21. 46.204.  3,   43.  2.  3.  9.254.  0. 12. 32.  0.138 :  .BYTE 2. 77.152. 35. 44. 12.  5. 32.
0.  0.  0.  1.255. 48. 24. 34.  0.136    13.254.  5.  7.254.  0. 12. 24.  0         .BYTE 131 (END 1)                    2.  5. 10.255.  0.  6. 13.  0
     .BYTE 1. 53.161. 20. 46.204.  2.         .BYTE    227.169.  1. 39.204.  7.    .BYTE 2. 45.161. 21. 46.235.  2.    0.  0.  4.  0.  0.  6. 15.  0.138
13.  2.  5.  8.254.  0. 12. 24.  0.132    0.  0.  0.  0.255. 32. 24. 32.  0        13.254.  5.  8.254.  0. 12. 24.  0         .BYTE    151.130.  5. 37. 12.  5.  0.
     .BYTE 1. 75.146. 29. 45.236.  4.         .BYTE    19.169.  1. 40.236.  7.     .BYTE    45.161. 19. 45.236.  4.    0.  0.  4.  0.  0.  6. 15.  0.138
21.254.  5.  9.254.  0. 12. 32.  0.136    0.  0.  0.  0.255. 48.255. 32.  0.148   26.254.  3.  8.254.  0. 12. 24.  0.136     .BYTE 135 (END 2)
     .BYTE 2. 57.161. 20. 46.204.  3.         .BYTE 2. 43.170. 12. 47.204.  3.     .BYTE 1. 57.146. 28. 45.204. 49.    :  .BYTE 1.191.145.  4. 36. 12.  3.  0
13.  2.  5.  8.254.  0. 12. 24.  0       10.  2.  5.  6.254. 32. 12. 19.  0        0.  2. 80.  9.254.  0. 12. 32. 21.136 0.  0.  4.255.  0.  6. 15.  0.132
     .BYTE    57.161. 18. 46.204.  4.         .BYTE    43.128. 12. 48.204.  3.     .BYTE 2. 29.170. 11. 47.236.  3.    :  .BYTE 1.251.152. 32. 44. 12.  4.128.
26.  2.  3.  8.254.  0. 12. 24.  0.136    10.  2.  5.  6.254. 48. 12. 61.  0.140  21.254.  3.  7.254. 32. 12. 19.  0     2.  1. 10.255.  0.  6. 13.  0.134
     .BYTE 133 (END 6)                         .BYTE 3. 31.161. 20. 46.204.  3.     .BYTE    29.170. 11. 48.235.  3.    :  .BYTE 1. 51.146. 29. 45.236.  6.
     .BYTE 2. 31.170. 12. 47.204.  2.    13.  2.  5.  7.254.  0. 12. 24.  0        21.254.  3.  7.254. 48. 12. 61.  0.132 21.254.  5.  9.254.  0. 12. 32.  0.140
10.  2.  5.  7.254. 32. 12. 19.  0             .BYTE    127.169.  1. 39.204.  7.    .BYTE 2.197.169.  1. 39.204.  3.    :  .BYTE 145 (END 3)
     .BYTE    31.128. 12. 48.204.  2.    0.  0.  0.  0.255. 32. 24. 32.  0        0.  0.  0.  1.255. 32. 24. 34.  0     :  .BYTE 2.249.160.  3. 35. 12.  4.  0.
10.  2.  5.  7.254. 48. 12. 61.  0.132         .BYTE    175.169.  1. 40.204.  7.    .BYTE    245.169.  1. 40.204.  3,  0.  0.  3.254.  0.  6. 13.  0
     .BYTE 1.159.161. 17. 46.204.  3.    0.  0.  0.  0.255. 48.255. 32.  0.148    0.  0.  0.  1.255. 48. 24. 34.  0.134 :  .BYTE    131.130.  5. 37. 12.  4.  0
52.254.  1.  8.254.  0. 12. 24.  0.134    13.  2.  5.  7.254.  0. 12. 24.  0        .BYTE 135 (END 2)                    0.  0.  4.  0.  0.  6. 15.  0.136
     .BYTE 1.166.146. 26. 45.204.  4.         .BYTE    247.154.  2. 41.204.  7.    .BYTE 2. 49.161. 20. 46.204.  2.    :  .BYTE 141 (END 4)
43.  2.  3.  9.254.  0. 12. 32.  0.136    0.  0.  0.  1.254.  0. 12. 36.  0.148   13.  2.  5.  8.254.  0. 12. 24.  0    :  .BYTE 1. 47.152.  4. 44. 12. 11. 64
     .BYTE 1.171.160.  3. 35. 12.  3.         .BYTE 2. 43.170. 12. 47.204.  3.     .BYTE    49.161. 18. 46.204.  4.    2.  3. 10.255.  0.  6. 13.  0.134
0.  0.  0.  3.254.  0.  6. 13.  0.134    10.  2.  5.  6.254. 32. 12. 19.  0        26.  2.  3.  8.254.  0. 12. 24.  0.136 :  .BYTE 1. 75.161. 19. 46.236.  4.
     .BYTE 1. 75.152. 37. 44. 44.  5.         .BYTE    43.128. 12. 48.204.  3.     .BYTE 1. 37.146. 29. 45.236. 49.    26.254.  3.  8.254.  0. 12. 24.  0.134
32.254.  5. 10.255.  0.  6. 13.  0.140    10.  2.  5.  6.254. 48. 12. 61.  0.140  0.254. 80.  9.254.  0. 12. 32. 21.136 :  .BYTE 1.165.146. 24. 45.204.  8. 36
     .BYTE 255 (END 7. END LEVEL 8)            .BYTE 1.111.160.  3. 35. 12.  5.     .BYTE 4.123.170. 12. 47.204. 17.    2.  1.  9.254.  0. 12. 32.  0.132
;LEVEL 9 (1198-2009)                      0.  0.  0.  2.254.  0.  6. 12.  0.144   0.  2. 80.  7.254. 32. 12. 19. 10    :  .BYTE 1. 51.161. 18. 46.204.  4. 26
     .BYTE 1.101.130.  5. 37. 12.  5.         .BYTE 2. 27.170. 13. 47.236.  3.     .BYTE    123.128. 12. 48.204. 17.    2.  3.  8.254.  0. 12. 24.  0.135
0.  0.  0.  4.  0.  0.  6. 15.  0.144    10.254.  5.  6.254. 32. 12. 19.  0        0.  2. 80.  7.254. 48. 12. 61. 10    :  .BYTE 149 (END 5)
     .BYTE 2.127.152. 33. 44. 12.              .BYTE    27.128. 13. 48.236.  3.     .BYTE    73.154.  2. 41.204.  5.    :  .BYTE 1. 71.161. 21. 46.236.  2.
5.128.254.  1.  9.255.  0.  6. 13.  0    10.254.  5.  6.254. 48. 12. 61.  0.140   0.  0.  0.  2.254.  0. 12. 37.  0    13.254.  5.  8.254.  0. 12. 24.  0.132
     .BYTE    71.115.  6. 38. 12.  7.         .BYTE 1. 33.161. 21. 46.236.  3.     .BYTE    253.154.  2. 41.204.  5.   :  .BYTE 1. 47.146. 26. 45.204.  7. 43
0.  0.  0.  5.  1.  0.  6. 16.  0.148    13.254.  5.  7.254.  0. 12. 24.  0.140   0.  0.  0.  2.254.  0. 12. 37.  0.138 2.  3.  9.254.  0. 12. 32.  0.138
     .BYTE 1    9.146. 27. 45.236.  4.         .BYTE 1.  9.146. 27. 45.236.  4,     .BYTE 139 (END 3)                    :  .BYTE 1.157.154.  2. 41.204.  3.  0
43.254.  3.  8.254.  0. 12. 32.  0.142    43.254.  3.  8.254.  0. 12. 32.  0.142    .BYTE 2. 65.170. 13. 47.236.  2.    0.  0.  2.254.  0. 12. 37.  0.134
     .BYTE 1.241.115.  6. 38. 12.  5.         .BYTE 2. 31.161. 20. 46.204.  3.    10.254.  5.  7.254. 32. 12. 19.  0     :  .BYTE 3. 41.170. 10. 47.204.  4. 21
0.  0.  0.  5.  1.  0.  6. 16.  0.144    13.  2.  5.  7.254.  0. 12. 24.  0         .BYTE    65.128. 13. 48.236.  3.    2.  3.  7.254. 32. 12. 19.  0
     .BYTE 2.193.152. 32. 44. 12.              .BYTE    131.130.  5. 37. 12.  7.   10.254.  5.  7.254. 48. 12. 61.  0.130 :  .BYTE    41.128. 10. 48.204.  4. 21
5.128.  2.  1.  9.255.  0.  6. 13.  0    0.  0.  0.  4.  0.  0.  6. 15.  0.148     .BYTE 1. 49.161. 18. 45.204.  4.    2.  3.  7.254. 48. 12. 61.  0
     .BYTE    71.145.  4. 36. 12.  7.         .BYTE 2. 27.170. 13. 47.236.  3.    26.  2.  3.  8.254.  0. 12. 24.  0.136 :  .BYTE    121.161. 16. 46.204.  5. 52
0.  0.  0.  3.255.  0.  6. 14.  0.148                                              .BYTE 1. 49.146. 29. 45.236.  3.    2.  1.  8.254.  0. 12. 24.  0.140
                                                                                                                      :  .BYTE 131 (END 6)
```

```
: .BYTE 2. 15.161. 17. 45.236.  6.
52.254.  1.  8.254.  0. 12. 24.  0
: .BYTE      85.154.  2. 41.204.  4.
0.  0.  0.  2.254.  0. 12. 37.  0.140
: .BYTE 2. 41.170. 10. 47.204.  4.
21.  2.  3.  7.254. 32. 12. 19.  0
: .BYTE      41,128. 10. 48.204.  4.
21.  2.  3.  7.254. 48. 12. 51.  0.136
: .BYTE 1.111.161. 16. 45.204.  4.
52.  2.  1.  8.254.  0. 12. 24.  0.135
: .BYTE 2. 53.146. 27. 45.236.  5.
43.254.  3.  9.254.  0. 12. 32.  0
: .BYTE      85.154.  2. 41.204.  7.
0.  0.  0.  2.254.  0. 12. 37.  0.142
;(END 7)
: .BYTE 2.101.169.  1. 39.204.  3.
0.  0.  0.  1.255. 32. 24. 34.  0
: .BYTE 149.169.  1. 40.204.  3.
0.  0.  0.  1.255. 48. 24. 34.  0.134
: .BYTE 2.199.170.  8. 47.204.  3.
41.  2.  1.  7.254. 32. 12. 19.  0
: .BYTE 199.128.  8. 48.204.  3.
41.  2.  1.  7.254. 48. 12. 61.  0.134
: .BYTE 1. 71.161. 19. 45.236.  4.
26.254.  1.  8.254.  0. 12. 24.  0.136
; .BYTE 135 (END 8)
; .BYTE 2. 71.170. 10. 47.204.  3.
21.  2.  3.  7.254. 32. 12. 19.  0
: .BYTE      71,128. 10. 48.204.  3.
21.  2.  3.  7.254. 48. 12. 61.  0.134
: .BYTE 1. 55.146. 29. 45.236.  3.
21.254.  5.  9.254.  0. 12. 32.  0.134
: .BYTE 1,161.152. 34. 44. 12.  6.
64.  2.  3. 10.255.  0.  6. 13.  0.142
: .BYTE 255 (END 9. END LEVEL 6)
   .END
      .LIB  REKEEP
;REKEEP IN MLCH0BK1.TXT OF ARM
REKEEP LDA  #0
       JSR  SETNAM
       LDA  #1
       LDX  #8
       LDY  #15
       JSR  SETLFS
       JSR  OPEN
       BCS  NODISK
       LDX  #1
       JSR  CHKOUT
       BCC  DISKON
NODISK LDA  #1
       JSR  CLOSE
       JSR  CLRCHN
       LDA  #0
       TAY
       JSR  FLOAT
       JMP  YSN080
DISKON LDA  #1
       JSR  CLOSE
       JSR  CLRCHN
       ADDR SA3.S1
       LDA  #S2-S1
       STA  LENSTR
       JSR  LETHL
YESNO  ADDR SA3.S2
       LDA  #S3-S2
       STA  LENSTR
       JSR  LETHL
       ADDR SA3.S3
       LDA  #S4-S3
```

```
       STA  LENSTR
       JSR  LETHL
       LDA  #1
       STA  V+39
       STA  V+28
       LDA  #42
       STA  2040
       LDY  #240
       LDA  #13
YSN010 STA  1583.Y
       DEY
       BNE  YSN010
       LDY  #200
YSN020 STA  1823.Y
       DEY
       BNE  YSN020
YSN030 LDX  #0
       LDA  53267    ;X READING
       SEC
       SBC  #5
       ASL  A
       BCC  YSN040
       INX
YSN040 CLC
       ADC  OFFX
       STA  V
       TXA
       ADC  OFFX+1
       TAX
       AND  #1
       BEQ  YSN050
       ORA  V+16
       JMP  YSN060
YSN050 LDA  V+16
       AND  #254
YSN060 STA  V+16
       LDA  53268    ;Y READING
       SEC
       SBC  #9
       CLC
       ADC  OFFY
       STA  V+1
       LDA  #1
       STA  V+21
       CPX  #0
       BNE  YSN070
       LDA  V
       CMP  #182
       BCS  YSN070
       LDA  #13
       JSR  COLYES
       LDA  #253
       JSR  COLNO
       LDY  #255
       JMP  YSN080
YSN070 LDA  #253
       JSR  COLYES
       LDA  #13
       JSR  COLNO
       LDY  #0
YSN080 LDA  56321
       CMP  #247
       BEQ  YSN090
       LDY  #100
       JSR  WAIT
       JSR  GETIN
       CMP  #0
       BEQ  YSN030
       LDY  #255
```

```
       CMP  #'Y
       BEQ  YSN090
       INY
       CMP  #'N
       BEQ  YSN090
       JMP  YSN030
YSN090 TYA
       PHA
       JSR  FLOAT
       LDA  #0
       STA  V+21
       LDA  #5
       STA  SA3
       PLA
       BEQ  YSN110
YSN100 LDA  #221
       JSR  COLNO
       JSR  COLYES
       LDY  #100
       JSR  WAIT
       LDA  #13
       JSR  COLYES
       LDY  #100
       JSR  WAIT
       DEC  SA3
       BNE  YSN100
       JMP  YSN120
YSN110 LDA  #221
       JSR  COLYES
       JSR  COLNO
       LDY  #100
       JSR  WAIT
       LDA  #13
       JSR  COLNO
       LDY  #100
       JSR  WAIT
       DEC  SA3
       BNE  YSN110
YSN120 JSR  NOTTRG
       RTS
YESNO2 ADDR SA3.S2
       LDA  #S3-S2
       STA  LENSTR
       JSR  LETHL
       ADDR SA3.S4
       LDA  #STEND-S4
       STA  LENSTR
       JSR  LETHL
       LDA  #1
       STA  V+39
       STA  V+28
       LDA  #42
       STA  2040
YS2030 LDX  #0
       LDA  53267    ;X READING
       SEC
       SBC  #5
       ASL  A
       BCC  YS2040
       INX
YS2040 CLC
       ADC  OFFX
       STA  V
       TXA
       ADC  OFFX+1
       AND  #1
       BEQ  YS2050
       ORA  V+16
       JMP  YS2060
```

```
YS2050 LDA  V+16
       AND  #254
YS2060 STA  V+16
       LDA  53268    ;Y READING
       SEC
       SBC  #9
       CLC
       ADC  OFFY
       STA  V+1
       LDA  #1
       STA  V+21
       LDA  V+1
       CMP  #150
       BCS  YS2070
       LDA  #13
       JSR  COLUP
       LDA  #253
       JSR  COLDN
       LDY  #1
       JMP  YS2080
YS2070 LDA  #253
       JSR  COLUP
       LDA  #13
       JSR  COLDN
       LDY  #2
YS2080 LDA  56321
       CMP  #247
       BEQ  YS2090
       LDY  #100
       JSR  WAIT
       JMP  YS2030
YS2090 TYA
       PHA
       LDA  #0
       JSR  FLOAT
       LDA  #0
       STA  V+21
       LDA  #5
       STA  SA3
       PLA
       CMP  #1
       BNE  YS2110
YS2100 LDA  #221
       JSR  COLDN
       JSR  COLUP
       LDY  #100
       JSR  WAIT
       LDA  #13
       JSR  COLUP
       LDY  #100
       JSR  WAIT
       DEC  SA3
       BNE  YS2100
       JMP  YS2120
YS2110 LDA  #221
       JSR  COLUP
       JSR  COLDN
       LDY  #100
       JSR  WAIT
       LDA  #13
       JSR  COLDN
       LDY  #100
       JSR  WAIT
       DEC  SA3
       BNE  YS2110
YS2120 JSR  NOTTRG
       RTS
COLYES LDX  #5
CY1    STA  1754.X
```

```
        STA     1794,X                  INY                     STA     SFD             SORT    ADDR    SFD,SRTBUF
        DEX                     DES040  LDA     (SFB),Y         PLA                     LDY     NSRT
        BPL     CT1                     STA     TEMP,X          STA     SFC             BEQ     SRT30
        RTS                             INX                     PLA                     DEY
COLNO   LDX     #3                      INY                     STA     SFB             BEQ     SRT30
CN1     STA     1770,X                  DEC     HOLD1           INC     HOLD1           STY     HOLD
        STA     1810,X                  BNE     DES049          LDA     HOLD1           LDY     #0
        DEX                             STX     LENSTR          CMP     #11     SRT10   LDA     (SFD),Y
        BPL     CN1                     ADDR    SA3,TEMP        BEQ     DES110          INY
        RTS                             JSR     LETML           JMP     DES060          CMP     (SFD),Y
COLUP   LDX     #1                      RTS             DES110  RTS                     BCC     SRT20   ;DON'T SORT
CU1     STA     1300,X          DES050  INC     HOLD1   DESC    .BYTE   17,212,'RACKING         TAX             :SWAP X VALS
        STA     1340,X                  LDA     HOLD1   '.197,'XERCISE'                 LDA     (SFD),Y
        DEX                     DES060  CMP     SFD     ;START          .BYTE   17,212,'RAPPING DEY
        BPL     CU1                     BNE     DES070  '.197,'XERCISE'                 STA     (SFD),Y
        RTS                             LDX     #14     :LIGHT BLUE     .BYTE   27,'60 M ',205,'OVING INY
COLDN   LDX     #1                      STX     646     '.212,'ARGET ',208,'RACTICE'    TXA
CD1     STA     1780,X          DES070  CMP     SFE     ;FINAL          .BYTE   27,'75 M ',205,'OVING STA     (SFD),Y
        STA     1820,X                  BCC     DES080  '.212,'ARGET ',208,'RACTICE'    TYA             :SWAP CORRE-
        DEX                             BEQ     DES080          .BYTE   28,'125 M ',205,'OVING CLC             : SPONDING Y
        BPL     CD1                     LDX     #0      :BLACK  '.212,'ARGET ',208,'RACTICE'    ADC     NSRT    : VALUES
        RTS                             STX     646             .BYTE   28,'185 M ',205,'OVING TAY
        .OPT    NOL             DES080  LDX     #32     '.212,'ARGET ',208,'RACTICE'    DEY
S1      .BYTE   137,'0617',196,'O YOU           STX     TEMP            .BYTE   27,198,'IELD ',198,'IRE - LDA     (SFD),Y
WANT TO KEEP RECORDS?'                  STX     TEMP+3  '.211,'INGLE ',212,'ARGETS'     TAX
S2      .BYTE   144,137,'0124',208,'OINT        ORA     #48             .BYTE   29,198,'IELD ',198,'IRE - INY
RIFLE AT ANSWER AND PULL TRIGGER'       STA     TEMP+1  '.205,'ULTIPLE ',212,'ARGETS'   LDA     (SFD),Y
S3      .BYTE                           CMP     #58             .BYTE   14,196,'EFENSIVE DEY
133,137,'1018',217,197,211,137,'2618',  BNE     DES090  '.198,'IRE'                     STA     (SFD),Y
206,207                                 LDA     #'1             .BYTE   11,195,'OMBAT ',198,'IRE' INY
S4      .BYTE                           STA     TEMP            .END                    TXA
133,137,'3606',138,'07',137,'3618',138  LDA     #'0             .LIB    GETXYSORT       STA     (SFD),Y
,'07'                                   STA     TEMP+1  ;PROCEDURE GETXY                TYA
STEND   =*              DES090  LDA     #':             ;DETERMINES BULLET STRIKE       SEC
        .OPT    LIST                    STA     TEMP+2  ;B:NONE                         SBC     NSRT
        .END                            LDY     #0      ;C:SYS GETXY                    TAY
        .OPT    NOL                     LDA     (SFB),Y ;A:PUTS THE BULLET STRIKE (X AND Y SRT20   CPY     HOLD
        .LIB    DESCRIPTIONS            PHA             ; VALUES) IN XVAL AND YVAL.     BNE     SRT10
;DESCRIPTIONS IN MLCH0BK1.TXT           TAY             GETXY   LDA     STSIZE          LDY     #0
; OF ARM CARTRIDGE              DES100  LDA     (SFB),Y         STA     NSRT            DEC     HOLD
DESCRP  ADDR    SFB,DESC                STA     TEMP+3,Y        JSR     SORT            BNE     SRT10
        LDX     HOLD1                   DEY                     LDA     STSIZE  ;FIND THE SRT30   RTS
        BEQ     DES050                  BNE     DES100          LSR     A       : MEDIAN OF    .END
        LDY     #0                      PLA                     TAX             : THE SRTBUF   .LIB    RANDOMIZE
DES010  DEX                             TAY                     LDA     SRTBUF,X ;PROCEDURE RNDIZE (RANDOMIZE)
        BEQ     DES020                  DINC    SFB             ASL     A       :*2     ;PUT START BYTE OF BUFFER AND
        LDA     (SFB),Y                 CLC                     STA     XVAL    :SET UP FOR ; STOP BYTE IN FA1.
        CLC                             ADC     SFB             LDA     #0      : ADDITION OF RNDIZE  JSR     SB1BF
        ADC     #1                      PHA                     BCC     GXY10   : OFFSET X      LDA     100     ;HIGH BYTE IS
        CLC                             LDA     SFC             LDA     #1      :BULLET RIGHT   STA     STOP    : BUF START
        ADC     SFB                     ADC     #0      GXY10   STA     XVAL+1          STA     HOLD
        STA     SFB                     PHA                     DADD    XVAL,OFFX       LDA     101     :LOW BYTE IS
        LDA     SFC                     LDA     SFD             LDA     STSIZE  ;FIND MEDIAN    STA     STOP+1  : BUF STOP
        ADC     #0                      PHA                     LSR     A       : OF THE        TAY
        STA     SFC                     LDA     SFE             CLC             : Y HALF OF     SEC
        JMP     DES010                  PHA                     ADC     STSIZE  : THE SRTBUF    SBC     STOP
DES020  LDA     #40                     LDA     #13             TAX                     STA     HOLD1
        SEC                             STA     TEMP+4,Y        LDA     SRTBUF,X        INY
        SBC     (SFB),Y                 INY                     STA     YVAL    :Y MEDIAN       INY
        LSR     A                       INY                     LDA     #0      :SET UP FOR     INC     STOP+1
        TAY                             INY                     STA     YVAL+1  ;OFFSET ADD Y   LDA     #255
        LDX     #0                      INY                     DADD    YVAL,OFFY       RNZ010  STA     16324,Y
DES030  LDA     #32                     INY                     RTS                     DEY
        STA     TEMP,X                  ADDR    SA3,TEMP ;                              BNE     RNZ010
        INX                             STY     LENSTR  ;PROCEDURE SORT         RNZ020  LDY     SA2     ;CLOCK
        DEY                             JSR     LETML   ;SORTS NSRT ELEMENTS IN SRTBUF          LDA     #0
        BNE     DES030                  PLA             ;B:POKE NSRT,(# OF ELEMENTS)            JSR     SB391   ;FLOAT
        LDA     (SFB),Y                 STA     SFE     ;C:SYS SORT                     JSR     SE26B   ;SINE
        STA     HOLD1                   PLA             ;A:ELEMENTS IN SRTBUF ARE SORTED        JSR     SBCOF   ;PUT IN FA2
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        LDY     HOLD1       ;STOP-START          SBC     EXPDAT+2,Y          BEQ     EXP100               RTS
        LDA     #0                               STA     YVAL                STA     HOLD3          ;STATIONARY
        JSR     SB391       ;FLOAT               LDA     EXPDAT+3,Y          JMP     EXP010         CRDATA  .BYTE 3.5.8.11      ;SP
        JSR     SBA2B       ;MULTIPLY            STA     CODE2          EXP100  RTS                          .BYTE 3.5.8.11      ;SF
        LDA     102         ;ABS                 LDA     #0             ;SPRITE PTR.STARTX.STARTY.TARGET     .BYTE 2.4.7.9       ;AIM
        AND     #127                             STA     S5D            FACTOR.BULLET FACTOR.NEXT            .BYTE 3.5.8.11      ;TS
        STA     102                              LDA     EXPDAT,Y       EXPDAT  .BYTE 39.48.33.2.1.11.0.0    .BYTE 2.4.7.9       ;SL
        LDY     #5E2        ;ADD .25             LDY     #6             ;50 M (L)                    ;60 M 1.5 MPH
        LDA     #5EA                        EXP020  ASL     A               .BYTE 41.48.74.4.2.0.0.0        .BYTE 5.10.16.21    ;TRACK
        JSR     SBA8C       ;LOAD FA2            ROL     S5D            ;100 M                               .BYTE 3.8.14.19     ;TRAP
        JSR     SB86A       ;ADD                 DEY                         .BYTE 35.34.37.3.3.0.0.0        .BYTE 5.11.18.24    ;AIM
        JSR     SB1BF       ;UNFLOAT             BNE     EXP020         ;150 M                               .BYTE 6.11.18.24    ;TS
        LDA     101         ;LOW BYTE            STA     S5C                 .BYTE 36.46.58.4.4.0.0.0        .BYTE 3.7.13.18     ;SL
        CLC                                 EXP030  LDY     #0          ;200 M                        ;60 M 3 MPH
        ADC     STOP                        EXP040  LDA     #3              .BYTE 37.52.77.5.5.0.0.0        .BYTE 5.10.16.21    ;TRACK
        TAY                                      STA     HOLDA          ;250 M                               .BYTE 3.8.14.19     ;TRAP
RNZ030  LDA     16325,Y                     EXP050  LDA     #128            .BYTE 38.59.99.6.6.0.0.0        .BYTE 5.11.18.24    ;AIM
        CMP     #255                             STA     CODE1          ;300 M                               .BYTE 6.11.18.24    ;TS
        BNE     RNZ040                      EXP060  LDA     (S5C),Y         .BYTE 47.24.20.2.1.12.0.0        .BYTE 3.7.13.18     ;SL
        LDA     HOLD                             AND     CODE1          ;60 M (B)                     ;60 M 6 MPH
        STA     16325,Y                          BEQ     EXP080              .BYTE 46.24.25.2.1.0.0.0        .BYTE 10.20.32.42   ;TRACK
        JMP     RNZ060                           LDA     CODE2          ;75 M                                .BYTE 3.8.14.19     ;TRAP
RNZ040  INY                                      STA     CODE3               .BYTE 45.48.56.4.2.0.0.0        .BYTE 5.11.18.24    ;AIM
        CPY     STOP+1                           STA     CODE4          ;125 M                               .BYTE 6.11.18.24    ;TS
        BCC     RNZ050                      EXP070  JSR     BITPLT          .BYTE 44.46.54.4.4.0.0.0        .BYTE 3.7.13.18     ;SL
        LDY     STOP                             DINC    XVAL           ;185 M                        ;75 M 1.5 MPH
RNZ050  JMP     RNZ030                           DEC     CODE3               .BYTE 40.0.33.2.1.0.0.0         .BYTE 5.10.16.21    ;TRACK
RNZ060  INC     HOLD                             BNE     EXP070         ;50 M (R)                            .BYTE 3.8.14.19     ;TRAP
        LDA     HOLD                             LDA     XVAL                .BYTE 48.24.62.2.1.0.0.0        .BYTE 5.11.18.24    ;AIM
        CMP     STOP+1                           SEC                    ;60 M (T)                            .BYTE 6.11.18.24    ;TS
        BCC     RNZ020                           SBC     CODE2               .END                            .BYTE 3.7.13.18     ;SL
        RTS                                      STA     XVAL                .LIB    CRITERION        ;75 M 3 MPH
        .END                                     LDA     XVAL+1         ;PROCEDURE CRITER                    .BYTE 5.10.16.21    ;TRACK
        .LIB    EXPTAR                           SBC     #0             ; POKE HOLD1,TARGET (0=STA. 1-12)    .BYTE 3.8.14.19     ;TRAP
;EXPTAR IN ARM.3200.TXT                          STA     XVAL+1         ; POKE HOLD2,SCORE DESIRED           .BYTE 5.11.18.24    ;AIM
;PROCEDURE EXPTAR                                LDA     CODE2          ; PUT THE SCORE IN FA1               .BYTE 6.11.18.24    ;TS
;POKE HOLD3,TARI.  POKE X1 WITH                  STA     CODE3          CRITER  JSR     UNPLOT              .BYTE 3.7.13.18     ;SL
; THE CENTER X, Y1 WITH CENTER Y                 INC     YVAL                   LDY     #1           ;75 M 6 MPH
; THE OFFSETS ARE CALCULATED AS:                 DEC     CODE4                  LDA     100                 .BYTE 10.20.32.42   ;TRACK
; (CENX*FACTOR-FACTOR/2.                         BNE     EXP070                 BNE     CRI050              .BYTE 3.8.14.19     ;TRAP
;  CENY*FACTOR-FACTOR/2)                         LDA     YVAL                   ADDR    SFD.CRDATA          .BYTE 5.11.18.24    ;AIM
; EXPDATA IS SPRITE POINTER.                     SEC                            LDY     HOLD1               .BYTE 6.11.18.24    ;TS
; OFFX,OFFY,FACTOR.                              SBC     CODE2                  BEQ     CRI020              .BYTE 3.7.13.18     ;SL
EXPTAR  LDA     #0                               STA     YVAL           CRI010  LDA     SFD          ;125 M 1.5 MPH
        STA     XVAL+1                      EXP080  LDA     XVAL                 CLC                         .BYTE 5.10.16.21    ;TRACK
        STA     CHOICE                           CLC                            ADC     #20                 .BYTE 3.8.14.19     ;TRAP
        LDA     HOLD3                            ADC     CODE2                  STA     SFD                 .BYTE 5.11.18.24    ;AIM
        AND     #127                             STA     XVAL                   LDA     SFE                 .BYTE 6.11.18.24    ;TS
        CMP     #7                               LDA     XVAL+1                 ADC     #0                  .BYTE 3.7.13.18     ;SL
        BCC     EXP010                           ADC     #0                     STA     SFE          ;125 M 3 MPH
        LSR     A                                STA     XVAL+1                 DEY                         .BYTE 5.10.16.21    ;TRACK
        LSR     A                                LSR     CODE1                  BNE     CRI010              .BYTE 3.8.14.19     ;TRAP
        LSR     A                                BNE     EXP060         CRI020  LDA     HOLD2               .BYTE 5.11.18.24    ;AIM
        CLC                                      INY                            ASL     A                   .BYTE 6.11.18.24    ;TS
        ADC     #6                               CPY     #63                    ASL     A                   .BYTE 3.7.13.18     ;SL
EXP010  SEC                                      BCS     EXP090                 TAY                  ;125 M 6 MPH
        SBC     #1                               DEC     HOLDA                  LDX     #5                  .BYTE 5.10.16.21    ;TRACK
        ASL     A                                BNE     EXP050                 LDA     101                 .BYTE 3.8.14.19     ;TRAP
        ASL     A                                LDA     HOLDX          CRI030  CMP     (SFD),Y             .BYTE 5.11.18.24    ;AIM
        ASL     A                                STA     XVAL                   BCC     CRI040              .BYTE 6.11.18.24    ;TS
        STA     HOLD3                            LDA     #0                     BEQ     CRI040              .BYTE 3.7.13.18     ;SL
        TAY                                      STA     XVAL+1                 DEX                  ;185 M 1.5 MPH
        LDA     X1                               LDA     YVAL                   INY                         .BYTE 5.10.16.21    ;TRACK
        SEC                                      CLC                            CPX     #1                  .BYTE 3.8.14.19     ;TRAP
        SBC     EXPDAT+1,Y                       ADC     CODE2                  BNE     CRI030              .BYTE 5.11.18.24    ;AIM
        STA     XVAL                             STA     YVAL           CRI040  TXA                         .BYTE 6.11.18.24    ;TS
        STA     HOLDX                            JMP     EXP040                 TAY                         .BYTE 3.7.13.18     ;SL
        LDA     Y1                          EXP090  LDY     HOLD3       CRI050  LDA     #0           ;185 M 3 MPH
        SEC                                      LDA     EXPDAT+5,Y             JSR     FLOAT               .BYTE 5.10.16.21    ;TRACK
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        .BYTE 3.8.14.19    :TRAP
        .BYTE 5.11.18.24   :AIR
        .BYTE 6.11.18.24   :TS
        .BYTE 3.7.13.18    :SL
:185 X 6 MPH
        .BYTE 5.10.16.21   :TRACK
        .BYTE 3.8.14.19    :TRAP
        .BYTE 5.11.18.24   :AIR
        .BYTE 6.11.18.24   :TS
        .BYTE 3.7.13.18    :SL
        .END
        .OPT  LIST
        .END
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*=32768
;MLCHOBK2.TXT FOR ARM CARTRIDGE
        JMP     DEMO
        JMP     SPCDEM
        JMP     SPCINS
        .LIB    MACROS-VARS
        .END
        .OPT    NOL
BANG    =3212
BITPLT  =3245
COLORS  =3227
DSABLE  =3203
ENABLE  =3200
NOTTRG  =3209
ROTATE  =3206
WAIT    =3218
WHISTL  =3215
YESNO   =32783
YESNO2  =32798
LETHL   =49185
PRGNUM  =49161
SELSUB  =49162
BANKSB  =49163
SUBNO   =49168
BANKRT  =49171
        .LIB    DEMOMAIN
;DEMOMAIN IN MLCHOBK2.TXT OF ARM
DEMO    DSPL    DDES03.DDES04
        LDA     #<YESNO2
        JSR     BANK1
        JSR     UNPLOT
        LDA     101
        CMP     #2
        BNE     DEM010
        RTS
DEM010  JSR     DEMSB4
        DSPL    DDES04.DDES05
        LDA     #3      ;185 M
        LDX     #2      ;6 MPH
        JSR     DEMSB5
        LDA     #0
        LDX     #0
        JSR     DEMSB1
        CMP     #255
        BNE     DEM020
        RTS
DEM020  JSR     DEMSB4
        DSPL    DDES05.DDES06
        LDA     #3      ;185 M
        LDX     #2      ;6 MPH
        JSR     DEMSB5
        LDA     #1
        LDX     #1
        JSR     DEMSB1
        CMP     #255
        BNE     DEM030
        RTS
DEM030  DSPL    DDES06.DDES07
        JSR     DEMSB3
        BEQ     DEM040
        RTS
DEM040  JSR     DEMSB4
        LDA     #0      ;60 M
        LDX     #0      ;1.5 MPH
        JSR     DEMSB6
        LDA     #2
        LDX     #99
        JSR     DEMSB1
        CMP     #255

        BNE     DEM050
        RTS
DEM050  JSR     DEMSB4
        LDA     #0      ;50 M
        LDX     #1      ;3 MPH
        JSR     DEMSB6
        LDA     #3
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM060
        RTS
DEM060  JSR     DEMSB4
        LDA     #0      ;50 M
        LDX     #2      ;6 MPH
        JSR     DEMSB5
        LDA     #4
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM070
        RTS
DEM070  JSR     DEMSB4
        LDA     #1      ;75 M
        LDX     #0      ;1.5 MPH
        JSR     DEMSB6
        LDA     #5
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM080
        RTS
DEM080  JSR     DEMSB4
        LDA     #1      ;75 M
        LDX     #1      ;3 MPH
        JSR     DEMSB6
        LDA     #6
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM090
        RTS
DEM090  JSR     DEMSB4
        LDA     #1      ;75 M
        LDX     #2      ;6 MPH
        JSR     DEMSB6
        LDA     #7
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM100
        RTS
DEM100  JSR     DEMSB4
        LDA     #2      ;125 M
        LDX     #0      ;1.5 MPH
        JSR     DEMSB6
        LDA     #8
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM110
        RTS
DEM110  JSR     DEMSB4
        LDA     #2      ;125 M
        LDX     #1      ;3 MPH
        JSR     DEMSB6
        LDA     #9
        LDX     #99
        JSR     DEMSB1

        CMP     #255
        BNE     DEM120
        RTS
DEM120  JSR     DEMSB4
        LDA     #2      ;125 M
        LDX     #2      ;5 MPH
        JSR     DEMSB5
        LDA     #10
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM130
        RTS
DEM130  JSR     DEMSB4
        LDA     #3      ;185 M
        LDX     #0      ;1.5 MPH
        JSR     DEMSB6
        LDA     #11
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM140
        RTS
DEM140  JSR     DEMSB4
        LDA     #3      ;185 M
        LDX     #1      ;3 MPH
        JSR     DEMSB5
        LDA     #12
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM150
        RTS
DEM150  JSR     DEMSB4
        LDA     #3      ;185 M
        LDX     #2      ;6 MPH
        JSR     DEMSB6
        LDA     #13
        LDX     #99
        JSR     DEMSB1
        CMP     #255
        BNE     DEM155
        RTS
DEM155  DSPL    DDES15.DDES16
        LDA     #<YESNO
        JSR     BANK1
        JSR     UNPLOT
        LDA     101
        BEQ     DEM160
        JMP     DEM040
DEM160  JSR     DEMSB4
        LDA     #1      ;75 M
        LDX     #1      ;3 MPH
        JSR     DEMSB5
        LDA     #14
        LDX     #4
        JSR     DEMSB1
        CMP     #255
        BNE     DEM170
DEM170  JSR     DEMSB4
        DSPL    DDES08.DDES09
        LDA     #43
        STA     2041
        STA     2042
        STA     2043
        LDA     #47
        STA     2044
        LDA     #48
        STA     2045

        LDA     #45
        STA     2046
        LDA     #44
        STA     2047
        LDX     #13
DEM180  LDA     DDATEV.X
        STA     V+2.X
        DEX
        BPL     DEM180
        LDA     #0
        STA     V+16
        STA     V+40
        STA     V+41
        STA     V+42
        LDA     #12
        STA     V+43
        STA     V+44
        STA     V+45
        STA     V+45
        LDA     #126
        STA     V+23
        STA     V+29
        LDA     #254
        STA     V+21
        DSPL    DDES01.DDES02
        JSR     DEMSB3
        LDX     #0
        STX     V+21
        CMP     #0
        BEQ     DEM190
        RTS
DEM190  DSPL    DDES09.DDES10
        JSR     DEMSB3
        BEQ     DEM200
        RTS
DEM200  JSR     DEMSB4
        LDA     #0      ;60 M
        LDX     #0      ;1.5 MPH
        JSR     DEMSB5
        LDA     #15
        LDX     #101
        JSR     DEMSB1
        CMP     #255
        BNE     DEM210
        RTS
DEM210  JSR     DEMSB4
        LDA     #0      ;60 M
        LDX     #1      ;3 MPH
        JSR     DEMSB6
        LDA     #16
        LDX     #101
        JSR     DEMSB1
        CMP     #255
        BNE     DEM220
        RTS
DEM220  JSR     DEMSB4
        LDA     #0      ;60 M
        LDX     #2      ;6 MPH
        JSR     DEMSB6
        LDA     #17
        LDX     #101
        JSR     DEMSB1
        CMP     #255
        BNE     DEM230
        RTS
DEM230  JSR     DEMSB4
        LDA     #1      ;75 M
        LDX     #0      ;1.5 MPH
        JSR     DEMSB5
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        LDA  #18                  JSR  DEMSB6               LDA  #42     ;CROSS        BNE  S1L100
        LDX  #101                 LDA  #25                  STA  2040                 LDY  #0
        JSR  DEMSB1               LDX  #101                 LDA  #34     ;BULLET       LDA  HOLD2
        CMP  #255                 JSR  DEMSB1               STA  2041                 AND  #32
        BNE  DEM240               CMP  #255                 LDA  #43     ;SPOST        BNE  S1L110
        RTS                       BNE  DEM305               STA  2042                 JMP  S1L040
DEM240 JSR  DEMSB4                RTS                       LDA  #12     ;MED GRAY  :S1L100 LDA  #0     ;BLACK
        LDA  #1      ;75 M      DEM305 DSPL DDES16.DDES17   STA  V+45              :      STA  V+38    ; CROSS
        LDX  #1      ;3 MPH       LDA  #(YESNO              STA  V+46              :      LDA  V+21
        JSR  DEMSB6               JSR  BANK1                LDA  #1      ;WHITE    :      AND  #249
        LDA  #19                 JSR  UNPLOT               STA  V+39              :      STA  V+21
        LDX  #101                 LDA  101                  STA  V+40           S1L100 JMP  S1L060
        JSR  DEMSB1               BEQ  DEM310               ADDR  SA3.DDESNN     S1L110 LDA  56321
        CMP  #255                 JMP  DEM200               LDY  #0                    CMP  #255
        BNE  DEM250            DEM310 JSR  DEMSB4           LDA  HOLD2                 BNE  S1L110
        RTS                       DSPL DDES10.DDES11        AND  #31                  LDA  #0
DEM250 JSR  DEMSB4                LDA  #3      ;185 M       TAX                       STA  V+38
        LDA  #1      ;75 M        LDX  #2      ;6 MPH       BEQ  S1L020               STA  V+21
        LDX  #2      ;6 MPH       JSR  DEMSB5           S1L010 LDA  (SA3).Y            LDA  #12
        JSR  DEMSB6               LDA  #26                  CLC                       STA  V+39
        LDA  #20                 LDX  #6                   ADC  #1                   TYA
        LDX  #101                 JSR  DEMSB1               CLC                       RTS
        JSR  DEMSB1               CMP  #255                 ADC  SA3               DEMSB2 LDY  #0
        CMP  #255                 BNE  DEM320               STA  SA3                  ADDR  SFB.DDAT
        BNE  DEM260               RTS                       LDA  SA4                  LDX  HOLD1
        RTS                    DEM320 JSR  DEMSB4           ADC  #0                   BEQ  S2L020
DEM260 JSR  DEMSB4                DSPL DDES11.DDES12        STA  SA4               S2L010 LDA  SFB
        LDA  #2      ;125 M       LDA  #3      ;185 M       DEX                       CLC
        LDX  #0      ;1.5 MPH     LDX  #2      ;6 MPH       BNE  S1L010               ADC  #15
        JSR  DEMSB5               JSR  DEMSB5           S1L020 LDA  (SA3).Y            STA  SFB
        LDA  #21                 LDA  #27                  STA  LENSTR               LDA  SFC
        LDX  #101                 LDX  #6                   DINC  SA3                 ADC  #0
        JSR  DEMSB1               JSR  DEMSB1               JSR  LETNL                STA  SFC
        CMP  #255                 CMP  #255                 JSR  DSABLE               DEX
        BNE  DEM270               BNE  DEM330               LDA  #59                  BNE  S2L010
        RTS                       RTS                       STA  53265            S2L020 LDA  #0
DEM270 JSR  DEMSB4            DEM330 DSPL DDES12.DDES13     BIT  HOLD2                STA  V+41    ;BLACK
        LDA  #2      ;125 M       JSR  DEMSB3               BVS  S1L030               STA  V+16
        LDX  #1      ;3 MPH       RTS                       JSR  HOLDIT               STA  V+21
        JSR  DEMSB6           SPCDEM JSR  UNPLOT        S1L030 LDA  #0                 LDA  #1
        LDA  #22                 LDA  101                  STA  CHOICE               STA  V+28    ;MULTICOLOR
        LDX  #101                 BNE  DSP010           S1L040 JSR  DEMSB2            STA  V+38    ;WHITE
        JSR  DEMSB1               JSR  DEMSB4               LDY  HOLD3                LDA  #6
        CMP  #255                 DSPL DDES13.DDES14        BMI  S1L110               STA  V+23    ;EXPAND Y
        BNE  DEM280               LDA  #1      ;75 M        LDA  HOLD2                STA  V+29    ;EXPAND X
        RTS                       LDX  #1      ;3 MPH       AND  #32                  LDA  #78     ;SET UP
DEM280 JSR  DEMSB4                JSR  DEMSB5               BNE  S1L050               STA  V+2     ; BULLET FOR
        LDA  #2      ;125 M       LDA  #28                  DSPL DDES01.DDES02        LDA  #185    ; CX DEMO
        LDX  #2      ;6 MPH       LDX  #7               S1L050 LDA  #255              STA  V+3
        JSR  DEMSB6               JSR  DEMSB1               STA  CHOICE               LDA  (SFB).Y ;X VALUE
        LDA  #23                 JMP  DSP020               LDA  #2                   STA  V+14
        LDX  #101             DSP010 JSR  DEMSB4            STA  HOLDY                STA  V+12
        JSR  DEMSB1               DSPL DDES14.DDES15    S1L060 LDA  #255              INY
        CMP  #255                 LDA  #1      ;75 M        STA  HOLDA                LDA  (SFB).Y ;Y VALUE
        BNE  DEM290               LDX  #1      ;3 MPH       STA  HOLDX                STA  V+15
        RTS                       JSR  DEMSB5           S1L070 LDA  56321             SEC
DEM290 JSR  DEMSB4                LDA  #29                  CMP  #247                 SBC  #42
        LDA  #3      ;185 M       LDX  #8                   BNE  S1L080               STA  V+13
        LDX  #0      ;1.5 MPH     JSR  DEMSB1               LDY  #128                 INY
        JSR  DEMSB6           DSP020 TAY                    JMP  S1L110               LDA  (SFB).Y ;SPRITE PTR
        LDA  #24                 JSR  FLOAT            S1L080 CMP  #127               STA  2047
        LDX  #101                 RTS                       BNE  S1L090               INY
        JSR  DEMSB1               .END                      LDY  #255                 LDA  (SFB).Y ;EXPAND X?
        CMP  #255                 .LIB  DEMOSUBS            JMP  S1L110               BPL  S2L030
        BNE  DEM300           ;DEMOSUBS FOR MLCH0BK2.TXT S1L090 DEC  HOLDA           LDA  V+29
        RTS                   DEMSB1 STA  HOLD1             BNE  S1L070               ORA  #192
DEM300 JSR  DEMSB4                STY  HOLD2                DEC  HOLDX                STA  V+29
        LDA  #3      ;185 M       LDA  #48     ;60M TOP     BNE  S1L070           S2L030 LDA  (SFB).Y ;EXPAND Y?
        LDX  #1      ;3 MPH       STA  2046                 DEC  HOLDY                AND  #64
```

```
        BEQ     S2L040
        LDA     V+23
        ORA     #192
        STA     V+23
S2L040  LDA     (SFB).Y ;RIGHT X?
        AND     #32
        BEQ     S2L050
        LDA     V+16
        ORA     #196
        STA     V+16
S2L050  INY
        LDA     (SFB).Y ;# READINGS
        STA     TLIN1+7
        STA     TLIN1+6
        INY
        LDA     (SFB).Y ;DELAY
        STA     DLSTK1+7
        STA     DLSTK1+6
        STA     DLSTK1+2
        STA     DLSTK1+1
        STA     CDLSTK+7
        STA     CDLSTK+6
        STA     CDLSTK+2
        STA     CDLSTK+1
        INY
        LDA     (SFB).Y ;TARGET
        STA     INSTK+7 ; INCREMENT
        STA     INSTK+6
        STA     INSTK+1
        INY
        LDA     (SFB).Y ;FLIGHT TIME
        STA     TIMFL1
        INY
        LDA     (SFB).Y ;SPOST
        STA     INSTK+2 ; INCREMENT
        INY
        LDA     (SFB).Y ;SPOST
        STA     CODE1   ; PAUSE
        BEQ     S2L060
        LDA     DLSTK1+2
        STA     CODE2
        LDA     #0
        STA     DLSTK1+2
S2L060  INY
        LDA     (SFB).Y ;SPOST X OFF
        CLC
        ADC     V+14
        STA     V+4
        INY
        LDA     (SFB).Y ;SPOST Y OFF
        CLC
        ADC     V+15
        STA     V+5
        INY
        LDA     (SFB).Y ;CROSS X/2
        ASL     A
        STA     V
        BCC     S2L070
        LDA     V+16
        ORA     #1
        STA     V+16
S2L070  INY
        LDA     (SFB).Y ;CROSS Y
        STA     V+1
        INY
        LDA     (SFB).Y ;WHICHSPRITES
        STA     V+21
        INY
        TYA
```

```
        CLC
        ADC     SFB
        STA     TARORD
        LDA     SFC
        ADC     #0
        STA     TARORD+1
        LDA     HOLD1
        CMP     #14
        BNE     S2L080
        LDA     #134
        STA     V+27
        DSPL    DDES07.DDES08
        JSR     HOLDIT
        LDA     #13
        STA     HOLD1
        LDA     #8
        STA     HOLD2
        LDA     #221
        STA     SFD
        JSR     COLORS
        LDA     #14
        STA     HOLD1
        LDA     #0
        STA     V+27
S2L080  LDA     V+14
        STA     HOLD3
        JSR     MOVESP
        JSR     DEMPAU
        BCS     S2L110
        LDA     V+14
        CMP     HOLD3
        BEQ     S2L080
        LDA     CODE1
        BEQ     S2L090
        DEC     CODE1
        BNE     S2L090
        LDA     CODE2
        STA     DLSTK1+2
S2L090  DEC     TLIN1+7
        BNE     S2L080
        JSR     BANG
        LDA     #0
        STA     INSTK+2
        LDA     V+21
        ORA     #1
        STA     V+21
:S2L100  LDA     V+14
:        STA     HOLD3
:        JSR     MOVESP
:        JSR     DEMPAU
:        BCS     S2L110
:        LDA     V+14
:        CMP     HOLD3
:        BEQ     S2L100
:        DEC     TIMFL1
:        BNE     S2L100
S2L100  LDA     #0
        STA     HOLD3
S2L110  RTS
DEMPAU  LDX     #255
        LDA     56321
        CMP     #127
        BEQ     DMP010
        LDX     #128
        CMP     #247
        BNE     DMP020
        BIT     CHOICE
        BPL     DMP020
DMP010  STX     HOLD3
```

```
        SEC
        RTS
DMP020  LDA     #S56
DMP030  SEC
        SBC     #1
        BNE     DMP030
        CLC
        RTS
:SUBROUTINE TO SET ZERO FLAG FOR
: TRIGGER PULL OR NEG FLAG FOR
: BREAK
DEMSB3  LDX     #0
        LDA     56321
        CMP     #247
        BEQ     S3L010
        DEX
        CMP     #127
        BNE     DEMSB3
S3L010  LDA     56321
        CMP     #255
        BNE     S3L010
        TXA
        RTS
:SUBROUTINE TO CLEAR SCREEN
: AND SET COLORS
DEMSB4  DSPL    DDES02.DDES03
        LDA     #12
        STA     HOLD1
        STA     HOLD2
        LDA     #221
        STA     SFD
        JSR     COLORS
        RTS
:SUBROUTINE TO PRINT RANGE (A) &
: MPH (X) AT BOTTOM LEFT
: A=0 (60). 1 (75).
:   2 (125). 3 (185)
: X=0 (1.5). 1 (3). 2 (6)
DEMSB5  ASL     A
        ASL     A
        STA     HOLD3
        TYA
        ASL     A
        ASL     A
        STA     HOLD4
        LDX     HOLD3
        LDA     TGTDS1.X
        STA     TEMP
        LDA     TGTDS1+1.X
        STA     TEMP+1
        LDA     TGTDS1+2.X
        STA     TEMP+2
        LDA     TGTDS1+3.X
        TAY
        LDX     #0    :'METERS'
S5L010  LDA     TGTDS2.X
        STA     TEMP.Y
        INY
        INX
        CPX     #9
        BNE     S5L010
        LDX     HOLD4
        LDA     TGTDS1+16.X
        STA     TEMP.Y
        LDA     TGTDS1+17.X
        STA     TEMP+1.Y
        LDA     TGTDS1+18.X
        STA     TEMP+2.Y
        TYA
```

```
        CLC
        ADC     TGTDS1+19.X
        TAY
        LDX     #0      :'MPH...'
S5L020  LDA     TGTDS2.X
        STA     TEMP.Y
        INY
        INX
        CPX     #18
        BNE     S5L020
        STY     LENSTR
        ADEF    SL3.TEMP
        JSR     LETML
        LDA     #19    :HOME
        JSR     SFFD2
        LDA     #14    :LT BLUE
        STA     645
        RTS
:SUBROUTINE TO PRINT RANGE (A) &
: MPH (X) AT TOP
: A=0 (60). 1 (75).
:  2 (125). 3 (185)
: X=0 (1.5). 1 (3). 2 (6)
DEMSB6  ASL     A
        ASL     A
        STA     HOLD3
        TYA
        ASL     A
        ASL     A
        STA     HOLD4
        LDA     #133
        STA     TEMP
        LDA     #137
        STA     TEMP+1
        LDA     HOLD3
        LDA     TGTDS4.X
        STA     TEMP+2
        LDA     TGTDS4+1.X
        STA     TEMP+3
        LDA     TGTDS4+2.X
        STA     TEMP+4
        LDA     TGTDS4+3.X
        STA     TEMP+5
        LDA     TGTDS1.X
        STA     TEMP+6
        LDA     TGTDS1+1.X
        STA     TEMP+7
        LDA     TGTDS1+2.X
        STA     TEMP+8
        LDA     TGTDS1+3.X
        CLC
        ADC     #6
        TAY
        LDX     #0     :'METERS'
S6L010  LDA     TGTDS2.X
        STA     TEMP.Y
        INY
        INX
        CPX     #9
        BNE     S6L010
        LDX     HOLD4
        LDA     #137
        STA     TEMP.Y
        INY
        LDA     TGTDS5.X
        STA     TEMP.Y
        INY
        LDA     TGTDS5+1.X
        STA     TEMP.Y
```

```
        INY                         BCS     MOV050      52.151.45.192.100.26.2.3.2.0.6.255.132    52.151.46.192.75.26.2.3.0.0.155.255.10
        LDA    TGTDS5+2.X           JMP     MOV050      .174.132     :75M4PF                      174.132     :75M4TR
        STA    TEMP.Y       MOV040  LDA     HOLD               .BYTE                       DDATZY .BYTE
        INY                         EOR     #255         16.161.46.224.100.13.254.5.254.0.246.2   57.154.156.154.244.154.60.160.60.118.1
        LDA    TGTDS5+3.X           AND     V+16         55.42.174.132 :75M8PF                    .147.250.165
        STA    TEMP.Y                      STA     V+16               .BYTE                DDESKM .BYTE 126.133.29.217.'OU MAY
        INY                         LDA     V.Y          165.146.45.192.50.86.2.1.2.0.2.7.139.1   '.28.'MISS'.154.' MOVING'.140
        LDA    TGTDS1+16.X          CMP     #20          67.132     :125M2PF                        .BYTE 'TARGETS BY AIMING ATCENT
        STA    TEMP.Y               BCS     MOV060             .BYTE                         MASS. BECAUSE'
        LDA    TGTDS1+17.X   MOV050 LDA     HOLD         23.146.45.224.50.43.254.3.254.0.250.7.       .BYTE 'THE '.28.'TARGET
        STA    TEMP+1.Y            ORA     OFFSCR        96.167.132 :125M4PF                  CONTINUES'
        LDA    TGTDS1+18.X                STA     OFFSCR            .BYTE                       .BYTE 'MOVING'.154.' AS THE
        STA    TEMP+2.Y      MOV060 DEY                  61.145.45.192.50.21.2.5.2.0.19.7.87.15  BULLET TRAVELS DOWN RANGE.'
        TYA                         DEY          7.132     :125M8PF                            .BYTE 125.133.212.'0 HIT A TARG
        CLC                         LSR     HOLD               .BYTE                       THAT'
        ADC    TGTDS1+19.X          DEX          147.152.44.0.25.128.254.1.254.0.242.24        .BYTE 29.'IS MOVING
        TAY                         BNE     MOV010       5.49.156.132  :185M2PF              LATERALLY'.140.'ACROSS YOUR FRONT.'.14
        LDX    #0    ;'MPH...'      RTS                        .BYTE                        .BYTE ' YOU MUST '.28.'AIM
S6L020  LDA    TGTDS6.X      HOLDIT  LDA     #255        141.152.44.0.25.64.2.3.2.0.250.245.96.  AHEAD'.154.140.' OF TARGET CENTER.'
        STA    TEMP.Y               TAX          156.132     :185M4PF                        .BYTE 140.212.'HIS IS CALLED
        INY                         LDY     #10                .BYTE                       '.28.204.197.193.196.154.'.'
        INX            HOLD01 SEC                          33.152.44.32.50.32.254.5.254.0.234.245   .BYTE 122.133.32.212.'E AMOUNT
        CPX    #22                  SBC     #1           .95.156.132  :185M8PF               OF LEAD'.140.' NEEDED TO HIT NEAR'
        BNE    S6L020               BNE     HOLD01             .BYTE                         .BYTE 140.' THE CENTER
        STY    LENSTR               DEX          55.161.46.192.100.26.2.3.2.20.45.255.1     CHANGES'.140
        ADDR   SA3.TEMP             BNE     HOLD01       34.174.134   :75M4SLDM                 .BYTE 'FOR DIFFERENT
        JSR    LETML                DEY                        .BYTE                       TARGET'.29.'RANGES. SPEEDS. AND'.140.2
        LDA    #19    ;HOME         BNE     HOLD01       41.170.47.192.100.41.2.1.2.0.6.250.129    .BYTE 'ANGLES OF MOVEMENT.'
        JSR    SPED2               RTS          .178.196    :60M2SL                           .BYTE 1.32
        LDA    #14    ;LT BLUE BANK1 STA     SUBNO              .BYTE                          .BYTE 122.133.32.212.'O SIMPLIF
        STA    646                  LDA     #1           23.170.47.224.100.21.254.3.254.0.250.2   TARGET'.140
        RTS                         STA     BANKSB       50.46.178.196 :60M4SL                    .BYTE 'LEADS PUT THE TRAIL-ING
MOVESP  LDY    #14                  LDA     BANKRT             .BYTE                       TIP OF THE FRONT'
        LDX    #7                   PHA          41.170.47.192.100.10.2.5.2.0.6.250.125         .BYTE 'SIGHT POST AT CENTEROF
        LDA    #128                 LDA     #2           .178.196    :60M8SL                   MASS. '.212.'HIS IS THE '.29
        STA    HOLD                 STA     BANKRT             .BYTE                       28.211.201.205.199.204.197.32.204.197.
MOV010  LDA    V+21                 JSR     SELSUB       180.161.46.192.50.52.254.1.254.0.248.2   3.196.32
        AND    HOLD                 PLA          55.43.174.132 :75M2SL                          .BYTE 210.213.204.197.154.'.'
        BEQ    MOV060               STA     BANKRT             .BYTE                         .BYTE 1.32
        LDA    DLSTK1.X ;STATIONARY? RTS                 52.161.46.192.100.26.2.3.2.0.6.255.132   .BYTE 125.32.133.32.212.'O USE
        BEQ    MOV060       TGTDS1 .BYTE '60 ',2.'75     .174.132    :75M4SL                 THE SINGLE'.140
        DEC    CDLSTK.X ;MOVE IT?   '.2.'125'.3.'185'.3.'1.5'.3.'3  '.1.'6   16.161.46.224.100.13.254.5.254.0.248.2     .BYTE 29.'LEAD RULE.
        BNE    MOV060               '.1          55.43.174.132 :75M8SL                      REMEMBER'.140
        LDA    HOLD         TGTDS2 .BYTE ' METERS'.140.32       .BYTE                         .BYTE 29.'TO PUT THE
        AND    OFFSCR       TGTDS3 .BYTE ' MPH LATERAL SPEED'   165.146.45.192.50.86.2.1.2.0.6.7.141.1  '.28.'TRAILING'.140.' TIP'.154
        BNE    MOV060       TGTDS4 .BYTE                        67.132     :125M2SL              .BYTE ' OF THE FRONT'.140.'SIGH
        LDA    DLSTK1.X            '1102'.'1102'.'1002'.'1002'        .BYTE                 POST AT '.28.'CENTER'.29
        STA    CDLSTK.X     TGTDS5 .BYTE '1305'.'1505'.'1505'   23.146.45.224.50.43.254.3.254.0.250.7.   .BYTE 'MASS'.154.' OF THE
        LDA    HOLD   ;CHECK TGTDS6 .BYTE ' MPH'.137.'0707LATERAL  96.167.132  :125M4SL     TARGET.'
        AND    V+16   ; RIGHT X     SPEED'                           .BYTE                      .BYTE 125.133.212.'E SINGLE L
        BEQ    MOV020       DDAT   .BYTE                        61.146.45.192.50.21.2.5.2.0.6.7.85.167  RULEWILL HIT MOST COMBAT'
        LDA    #1           51.152.44.0.100.32.2.5.2.0.244.245.121  .132     :125M8SL            .BYTE 'TARGETS. '.212.'O HIT
MOV020  STA    HOLDX        .156.132    :185M8ML              .BYTE                       '.28.'FAST'.154.' LATERAL TARGETS AT'
        LDA    INSTK.X ;ADD         .BYTE                 147.152.44.0.25.128.254.1.254.0.338.24       .BYTE 140.28.'MORE THAN 100
        STA    HOLDY  ; INCREMENT   51.152.44.0.100.32.2.5.2.0.254.245.126  5.47.156.132 :185M2SL    METERS'.154.29.'YOU NEED MORE LEAD.'
        CLC          .156.132    :185M8PF                      .BYTE                       .BYTE 104.133.29.32.212.'O
        ADC    V.Y                  .BYTE                 141.152.44.0.25.64.2.3.2.0.250.245.96.  '.28.'TRACE'.154.'. GET THE'.140
        STA    V.Y          41.170.47.192.100.41.2.1.2.0.2.250.127  156.132    :185M4SL        .BYTE ' CORRECT LEAD AND'.140
        LDA    #0           .178.196    :60M2PF                    .BYTE                    .BYTE 'MOVE YOUR RIFLE WITH'.29
        BIT    HOLDY  ;INCREMENT<0?  .BYTE                 33.152.44.32.50.32.254.5.254.0.239.245  THE TARGET AS YOU'.140
        BPL    MOV030       23.170.47.224.100.21.254.3.254.0.250.2  .98.156.132  :185M8SL         .BYTE 28.'SQUEEZE'.154.' THE
        LDA    #255         50.46.178.196 :60M4PF         33.152.44.32.50.32.254.5.254.0.234.245  TRIGGER.'
MOV030  ADC    HOLDX               .BYTE                  .95.156.132  :185M8PF                 .BYTE 126.133.212.'0
        BEQ    MOV040       41.170.47.192.100.10.2.5.2.0.10.250.12       .BYTE              '.28.'TRAP'.154.'. ESTABLISH A'
        LDA    HOLD         7.178.196   :60M8PF           52.161.46.192.75.26.2.3.2.0.6.255.107.   .BYTE ' STEADY POSITION IN'.14
        ORA    V+16                .BYTE                  174.132    :75M4TK               .BYTE 29.'FRONT OF THE
        STA    V+16         180.161.46.192.50.52.254.1.254.0.254.2        .BYTE            TARGET'.140.'AND '.28.'PULL'.154.' TH
        LDA    V.Y          55.46.174.132 :75M2PF                                          .BYTE 'TRIGGERWHEN THE TARGET
        CMP    #80                 .BYTE
```

GETS'.29.' TO THE RIGHT SPOT.'
DDES01 .BYTE 144.137.'0723('.208.'ULL
TRIGGER TO CONTINUE)'
        .BYTE 19.154.134.'00'
DDES02 .BYTE
134.'09'.139.'00'.147.135.'00'.136.'00
',28.137.'0121'
DDES03 .BYTE
134.'09'.139.'00'.135.'13'.136.'13'.14
7.144.133.137.'0204'
        .BYTE 205.'OVING
',212.'ARGET'.140.32.201.'NSTRUCTION
AND'.140
        .BYTE
32.196.'EMONSTRATION'.137.'0216'.211.'
TART'.140
        .BYTE
32.198.'IRING'.140.32.197.'XERCISES'.1
34.'00'
DDES04 .BYTE
144.137.'1020'.215.'ITHOUT LEAD YOU
'.28.'MISS'.140.32
DDES05 .BYTE 144.137.'1120'.215.'ITH
LEAD YOU '.28.'HIT'.140.32
DDES06 .BYTE
134.'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
        .BYTE 32.212.'HE AMOUNT OF
'.28.'LEAD'.140.154
        .BYTE 'NEEDED TO HIT
TARGETCENTER WILL '.28.'INCREASE'.154
        .BYTE ' WHEN THE TARGET
IS'.140.29.28.'FARTHER '.154.'AWAY
AND/OR'
        .BYTE 140.' IS MOVING
'.28.'FASTER'.140.154
        .BYTE ' LATERALLY
ACROSS'.140.29.' YOUR FRONT.'.140
        .BYTE 29.'12 EXAMPLES
FOLLOW.'.133.137.'0523'
        .BYTE 1??.'('.208.'ULL TRIGGER
FOR 12 EXAMPLES)'.134.'04'
DDES07 .BYTE 144.137.'0219'.195.'ENTER
OF'.137.'0420MASS'
        .BYTE 137.'1113'.212.'RAILING
TIP OF'.137.'1114FRONT SIGHT POST'
        .BYTE
133.137.'0617'.138.'01'.137.'1115'.138
.'05'
DDES08 .BYTE 19.154.133.'
',206.'OTICE HOW THE',140.' SINGLE
LEAD RULE'
        .BYTE 140.29.'WORKS
AUTOMATICALLY'.140.' AS THE TARGET
GETS'.140
        .BYTE 29,'SMALLER (IS
FARTHER'.140.' AND FARTHER AWAY).'.144
        .BYTE
137.'1012'.138.'03'.137.'2013'.138.'03
'.137.'3113'.138.'03'
        .BYTE 133.137.'062060
K'.137.'1719125 K'.137.'2819185 K'
DDES09 .BYTE
134.'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
        .BYTE 198.'OLLOWING ARE
ELEVEN'.29.' EXAMPLES OF THE'.140
        .BYTE 28.29.' SINGLE LEAD
RULE'.154.','.140

        .BYTE 29.' SHOWING WHERE
THE'.140.29.'BULLET WILL HIT THE'.140
        .BYTE 29.'TARGET. '.206.'OTICE
THAT'.140
        .BYTE 29.'THE '.28.'TRAILING
TIP'.154.' OF'.140
        .BYTE 'THE SIGHT POST IS AT
'.28.'CENTER MASS'.154.'.'.133
        .BYTE 137.'0423'.'('.208.'ULL
TRIGGER TO SEE 11 EXAMPLES)'.134.'04'
:DDES10 .BYTE 28.137.'0220'.198.'AR
AND FAST TARGETS NEED MORE LEAD.'
:
:DDES11 .BYTE 28.137.'1220'.212.'HIS
IS A '.212.210.193.195.293.'.'.140.32
DDES10 .BYTE
144.137.'0420'.201.'NSUFFICIENT LEAD
CAUSES A '   -
        .BYTE 28.'MISS'.140.32
DDES11 .BYTE
144.137.'0920'.201.'NCREASED LEAD - A
'
        .BYTE 28.'HIT'.140.32
DDES12 .BYTE
134.'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
        .BYTE 32.212.'WO WAYS TO
ENGAGE'.140.' MOVING TARGETS ARE'
        .BYTE
140.28.212.210.193.195.203.201.206.199
.154.32.38.32
        .BYTE
28.212.210.193.208.208.201.206.199.154
.'.'.29
        .BYTE 217.'OU WILL GET TO
TRY'.140.29.'BOTH METHODS TO SEE'.140
        .BYTE ' HOW THEY
WORK.'.133.153
        .BYTE 137.'0723('.208.'ULL
TRIGGER TO CONTINUE)'.134.'00'
DDES13 .BYTE 144.137.'1220'.212.'HIS
IS A '.28
        .BYTE
212.210.193.195.203.144.','.140.32.28
DDES14 .BYTE 144.137.'1220'.212.'HIS
IS A '.28
        .BYTE
212.210.193.208.144.'.'.140.32.28
DDES15 .BYTE
134.'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
        .BYTE 32.196.'O YOU WANT TO
SEE'.140
        .BYTE 29.' THE 12
EXAMPLES'.140.29.'
AGAIN?'.134.'08'
DDES16 .BYTE
134.'09'.139.'00'.135.'00'.136.'00'.14
7.154.133.140
        .BYTE 32.196.'O YOU WANT TO
SEE'.140
        .BYTE ' THE 11 EXAMPLES
OF'.140.'THE SINGLE LEAD RULE'
        .BYTE '   AGAIN?'.134.'08'
DDES17 =*
        .END
        .LIB SPECINSTR
;SPECINSTR IN MLCH0BK2.TXT
SPCINS JSR   UNFLOT

        LDA   101
        BNE   SPC010
        ADDR SA3.INST02
        LDA   #INST03-INST02
        BNE   SPC040
SPC010 CMP   #1
        BNE   SPC020
        ADDR SA3.INST03
        LDA   #INST04-INST03
        BNE   SPC040
SPC020 CMP   #2
        BNE   SPC030
        ADDR SA3.INST04
        LDA   #INST05-INST04
        BNE   SPC040
SPC030 ADDR SA3.INST05
        LDA   #INST06-INST05
        STA   LENSTR
        JSR   LETHL
        ADDR SA3.INST06
        LDA   #INST07-INST06
SPC040 STA   LENSTR
        JSR   LETHL
        DSPL INST01.INST02
SPC050 LDY   #0
        LDA   56321
        CMP   #247
        BEQ   SPC060
        DEY
        CMP   #127
        BNE   SPC050
SPC060 TYA
        JSR   FLOAT
SPC070 LDA   56321
        CMP   #255
        BNE   SPC070
        RTS
INST01 .BYTE 137.'0723('.208.'ULL
TRIGGER TO CONTINUE)'.134.'00'
INST02 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
.'0402'.28
        .BYTE 198.'UNDAMENTALS
FOR'.137.'0205'.211.'TATIONARY '
        .BYTE 137.'0108'.133.'.'.
'.133.211.'TEADY '.208.'OSITION'
        .BYTE 137.'0111'.133.'.'.
'.133.193.'IMING'
        .BYTE 137.'0114'.133.'.'.
'.133.194.'REATH '.195.'ONTROL'
        .BYTE 137.'0117'.133.'.'.
'.133.212.'RIGGER
'.211.'QUEEZE'.133.153
INST03 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
.'0402'.28
        .BYTE 198.'UNDAMENTALS
FOR'.137.'1205'.212.'RACKING'.137.'120
7'
        .BYTE
163.163.163.163.163.163.163.163
        .BYTE 137.'0608'.205.'OVING
'.212.'ARGETS'.30
        .BYTE 137.'0111'.133.'.'.
'.133.211.'HOOTE '.212.'RACK'
        .BYTE 137.'0114'.133.'.'.
'.133.204.'EAD'
        .BYTE 137.'0117'.133.'.'.

'.133.194.'REATH '.195.'ONTROL'
        .BYTE 137.'0120'.133.'.'.
'.133.212.'RIGGER '.211.'QUEEZE'.133.15
INST04 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
.'0402'.28
        .BYTE 198.'UNDAMENTALS
FOR'.137.'1205'.212.'RAPPING'.137.'120
        .BYTE
163.163.163.163.163.163.163.163
        .BYTE 137.'0608'.205.'OVING
'.212.'ARGETS'.30
        .BYTE 137.'0111'.133.'.'.
'.133.211.'TEADY '.208.'OSITION'
        .BYTE 137.'0114'.133.'.'.
'.133.204.'EAD'
        .BYTE 137.'0117'.133.'.'.
'.133.194.'REATH '.195.'ONTROL'
        .BYTE 137.'0120'.133.'.'.
'.133.212.'RIGGER '.208.'ULL'.133.153
INST05 .BYTE
134.'09'.147.135.'00'.136.'00'.133.137
.'0402'.28
        .BYTE 198.'UNDAMENTALS
OF'.137.'0805'.205.'ARKSMANSHIP'
        .BYTE
133.30.137.'0010'.211.'TATIONARY '
        .BYTE 205.'OVING ('.212.'RACK
'.205.'OVING ('.212.'RAP)'
        .BYTE
183.183.183.183.183.183.183.183.183.18
32.32
        .BYTE
183.183.183.183.183.183.183.183.183.18
183.183.183.183
        .BYTE
32.183.183.183.183.183.183.183.183.183
83.183.183.183
INST06 .BYTE 211.'TEADY '.208.'OS
'.211.'HOOTE '.212.'RACK   '
        .BYTE 211.'TEADY
'.208.'OS'.140.193.'IMING   '
        .BYTE 204.'EAD
'.204.'EAD'.140
        .BYTE 194.'REATH '.195.'ON
'.194.'REATH '.195.'ON   '
        .BYTE 194.'REATH '.195.'ON'.140
        .BYTE 212.'RIGGER '.211.'Q
'.212.'RIGGER '.211.'Q
        .BYTE 212.'RIG '.208.'ULL'.153
INST07 =*
        .END
        .OPT LIST
        .END

```
*=49152                     LDX #0                      JSR MOVEIT                  STA (SA3),Y
.OPT NOL                    JSR PREPAR                  BIT 101                     DEY
.LIB MACROS-VARS            JSR DSABLE                  BVC PREPAR                  BPL INL020
.OPT NOL                    LDA #0                      RTS                         LDA SA3
ENABLE =3200               STA V+39          MOVEIT LDY #0                          CLC
DSABLE =3203               STA V+28          MVL030 LDA (SA3),Y                     ADC #40
SCENE =3221                STA V+29                   STA (SFD),Y                    STA SA3
CTRREG =16192              STA V+23                   DINC SA3                       LDA SA4
SCRCT1 =16193              LDA #34                    DINC SFD                       ADC #0
SCRCT2 =16194              STA 2040                   LDA SFD                        STA SA4
GUNDL =16195               ADDR SFD,35154             CMP STOP                       DEX
LETBUF =58789              LDA #0                      BNE MVL030                    BNE INL010
   .WORD ESTART-16384,$FEBC STA SFB    ;CHIP #/BANK    LDA SFE              INL040 LDA SA1
   .BYTE 195,194,205,56,48  JSR SCENE                  CMP STOP+1                    AND #2
PRGNUM .BYTE 0              SEI                         BNE MVL030                    BEQ INL070
;                          ADDR $314,START             RTS                           LDA #15    ;GUN BANG
;PROCEDURE SELSUB          ADDR SFB,FN16      SECLET JSR GETIN                       STA 54296
; SELECTS SUBROUTINE ON CHOBK1 LDA #40               CMP #0                          LDA #10
; BY POKING ADDRESS FROM BASIC STA SCRCT1            BEQ SECLET                      STA 54277
SELSUB LDA #1               LDA #1                     RTS                           LDA #30
   STA $DFFF                STA CTRREG         LETERS JSR LETSB1                      STA 54273
   JSR 32768               LDA #0                     JSR 57344                       LDA #128
   LDA #32                 STA SA1                    JSR LETSB2                      STA 54276
   STA $DFFF               STA SA2                    RTS                             LDA #129
   RTS                     CLI                LETHL LDY LENSTR                        STA 54276
   JMP ARM    ;ARM PROG    JMP MVL020        LET010 LDA (SA3),Y                       LDA #15
   JMP PRGSEL ;PRGSEL     PRGSEL LDX #CALIB-DATA      STA LETBUF,Y                    STA V     ;X: SPRITE 0
   JMP LETERS              JSR PREPAR                  DEY                            LDA #208
   JMP LETHL        MVL010 LDA #21  ;TEXT SCREEN       CPY #255                       STA V+1   ;Y: SPRITE 0
ESTART STX $D016           STA 53272                   BNE LET010                     LDA #1
   JSR $FDA3  ;IOINIT      LDA #27                    ADDR SA3,LETBUF                 STA V+16  ;RIGHT X
   JSR $FD50  ;RAMTAS      STA 53265                   JSR LETSB1                     STA V+21  ;SPRITE CTRRG
   JSR $FD15  ;RESTOR      LDA #147 ;CLEAR SCREEN      JSR 57347                      LDA #0
   JSR $FF5B  ;CINT        JSR $FFD2                   JSR LETSB2                     STA SA1
   CLI              MVL020 LDA #32  ;RAM               RTS                            LDA CTRREG
   JSR $E453  ;COPY VECTORS STA $DFFF          LETSB1 JSR DSABLE                      ORA #8
   JSR $E3BF  ;INIT        LDA #0                     SEI                             STA CTRREG
   ADDR $FD,57344          STA 198                     LDA 1                         ADDR SA3,1334
   ADDR STOP,LETBUF        JSR $A871                   AND #253                       LDX #9
   ADDR $A3,39515          JMP $A7AE  ;RUN             STA 1                   INL050 LDY #6
   JSR MOVEIT-16384  PREPAR LDA DATA,X                 RTS                            LDA #17
ARM LDA #0                  STA 101            LETSB2 LDA 1                     INL060 STA (SA3),Y
   STA 53280               AND #63                    ORA #7                          DEY
   STA 53281               STA $DFFF                   STA 1                          BPL INL060
   STA $DFFF               INX                         JSR ENABLE                     LDA SA3
   LDA #43                 LDA DATA,X                  RTS                            CLC
   STA 53265               STA SFD              DATA .BYTE 7    ;ARM,3200             ADC #40
   ADDR SFD,49152          INX                      .WORD 3200,7996,32768            STA SA3
   ADDR STOP,FIN           LDA DATA,X                .BYTE 2    ;ARM.SPRITES          LDA SA4
   ADDR SA3,$8000          STA SFE                  .WORD 2176,3200,39936            ADC #0
   JSR MOVEIT-16384        INX                      .BYTE 4    ;ARM.BAS (1)           STA SA4
   JMP NEWLOC              LDA DATA,X                .WORD 16384,24576,32768          DEX
NEWLOC LDA #234 :DISABLE STOP STA STOP               .BYTE 5    ;ARM.BAS (2)          BNE INL050
   STA 808    : KEY        BIT 101                  .WORD 24576,32768,32768          LDA #<13960
   LDA #128 ;DISABLE CDR/  BPL PREP20               .BYTE 198  ;ARM.BAS (3)          STA SFB
   STA 657  ; SHIFT KEYS   STA 45                   .WORD 32768,37188,32768          LDA #<13968
   LDA #<16384 ;BASIC START PREP20 INX        CALIB .BYTE 193   ;CALIBRATION         STA SC3
   STA 641  ;OS BOTTOM L   LDA DATA,X               .WORD 16384,17213,40131          LDA #>13968
   LDA #>16384             STA STOP+1               .LIB INTRO                       STA SFE
   STA 44   ;BASIC BOT H   BIT 101            ;INTRO FOR ARM CARTRIDGE INTRO         STA SC4
   STA 642  ;OS BOTTOM H   BPL PREP30         START LDA SA2                          LDA #5
   LDA #<16385             STA 46                    AND #3                          STA GUNDL
   STA 43   ;BASIC BOT L PREP30 INX                  BNE INL040              INL070 LDA CTRREG
   ADDR 55,40960 ;BASIC TOP LDA DATA,X               ADDR SA3,1226                   AND #1
   LDA #0                  STA SA3                    LDX #12                         BEQ INL130
   STA PRGNUM             INX                 INL010 LDY #3                           LDA SA2  ; SCROLL
   STA 198                LDA DATA,X          INL020 LDA (SA3),Y                      AND #7
   STA V+16               STA SA4                    CLC                             BNE INL130
   STA V+21               INX                        ADC #16                         LDY #0
```

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INL080 LDA 15880.Y          LDA SFD              BPL INL210            .BYTE
       STA 15872.Y          CLC                  LDA SA3       24.24.24.0.0.0.124.102.96.96.96.0.0.0.
       INY                  ADC #64              CLC           .6.62.102.62.0.0.24
       BNE INL080           STA SFD              ADC #40              .BYTE
INL090 LDA 16136.Y          LDA SFE              STA SA3       0.56.24.24.60.0.0.0.124.192.102.102.10
       STA 16128.Y          ADC #1               LDA SA4       0.0.24.0.56.24.24
       INY                  STA SFE              ADC #0               .BYTE
       CPY #56              DEC GUNDL            STA SA4       60.0.0.0.124.102.102.102.102.0.0.0.62
       BNE INL090           BNE INL170           DEX           2.102.62.6.124
       LDY #7               LDA #10              BNE INL200           .BYTE
INL100 LDA (SFB).Y          STA GUNDL     INL220 LDA CTRREG     254.254.254.254.254.254.254.254
       CMP #254             LDA CTRREG           AND #64       PTTB .BYTE
       BEQ INL110           EOR #24              BEQ INL280    0.192.60.255.60.102.0.0.0.192.60.255.
       STA 16184.Y          STA CTRREG           DEC SCRCT1  ;DELAY PSB  102.0.0.0.102
       DEY           INL170 LDA CTRREG           BNE INL280           .BYTE
       BPL INL100           AND #16              DEC SCRCT2    60.255.60.102.0.0.0.0.0.0.0.0.0.0.124
       LDA SFB              BEQ INL180           BNE INL240    2.102.124.96
       CLC                  JSR SPRUPD           LDA CTRREG           .BYTE
       ADC #8               DEC GUNDL   ;GUN DELAY  EOR #55     96.96.0.0.0.102.102.102.102.62.0.0.56.
       STA SFB              BNE INL180           STA CTRREG    .24.24.24.50
       LDA SFC              LDA CTRREG           ADDR SFB.FH16        .BYTE
       ADC #0               EOR #48              LDY #40       0.0.56.24.24.24.60.0.0.0.0.0.0.0.0.0
       STA SFC              STA CTRREG           STY SCRCT1    0.24.126.24.24
       JMP INL130           LDA #5               DEY                  .BYTE
INL110 LDA #0               STA GUNDL            LDA #177      24.14.0.0.0.124.102.95.96.96.95.0.0.24.0
       STA 16184.Y          LDA #<13952   INL230 STA 1984.Y    .24.24.50.0.0
       DEY                  STA SFD              DEY                  .BYTE
       BPL INL110           LDA #<13960          BPL INL230    0.62.102.102.62.6.124.0.0.62.102.102.
       DEC SCRCT1           STA SC3              JMP INL260    6.124.0.0.50
       BNE INL130           LDA #>13960   INL240 LDA SCRCT2           .BYTE
       LDA #3               STA SFE              AND #1        102.126.95.60.0.0.124.102.95.96.96.
       STA SCRCT2           STA SC4              BEQ INL250    .0.0.0.0
       EOR CTRREG    INL180 LDA CTRREG           LDA CTRREG           .BYTE
       STA CTRREG           AND #32              EOR #66       0.0.24.126.24.24.24.14.0.0.0.60.102.1
       LDY #39              BEQ INL220           STA CTRREG    102.60.0.0.0
       LDA #33              LDY #240   ;KICK RIGHT  JMP INL280         .BYTE
INL120 STA 1984.Y           JSR SPRUPD    INL250 LDA #50        0.0.0.0.0.0.96.96.124.102.102.124.0
       DEY           INL190 LDA (SFD).Y           STA SCRCT1    0.60.102.126
       BPL INL120           STA (SC3).Y   INL260 LDY #247              .BYTE
INL130 LDA CTRREG           DEY                  LDA #0        96.60.0.0.0.62.102.102.62.6.124.0.24.
       AND #2               CPY #255      INL270 STA 15912.Y    5.24.24.60.0
       BEQ INL150           BNE INL190           DEY                  .BYTE
       LDY #232  ;BLINK     LDA SC3              BNE INL270    0.0.124.102.102.102.102.0.0.0.0.0.0.0
INL140 LDA PTTB-1.Y         CLC           INL280 JMP SEA31     0.0.102.60.255
       STA 15919.Y          ADC #64       SPRUPD INC V   ;X: SPRITE 0        .BYTE
       DEY                  STA SC3              INC V         60.102.0.0.0.102.60.255.60.102.0.0.0.
       BNE INL140           LDA SC4              INC V         .60.255.60.102.0.0.0
       LDA #180             ADC #1               RTS                  .END
       STA SCRCT1           STA SC4        FH15 .BYTE          FIN =*
       LDA CTRREG           LDA SFD       126.96.96.120.96.96.96.0.0.0.60.102.10  .OPT LIST
       EOR #66              CLC           2.102.60.0.0.0.124.102       .END
       STA CTRREG           ADC #64              .BYTE
INL150 LDA CTRREG           STA SFD       96.96.96.0.0.0.0.0.0.0.0.0.99.119.127.
       AND #8               LDA SFE       107.99.99.99.0.0.0.50
       BEQ INL170           ADC #1               .BYTE
       LDY #0   ;KICK LEFT  STA SFE       102.102.102.60.0.0.0.102.102.102.60.24
       JSR SPRUPD           DEC GUNDL     .0.0.24.0.56.24.24.60
INL160 LDA (SC3).Y          BNE INL220           .BYTE
       STA (SFD).Y          LDA CTRREG    0.0.0.124.102.102.102.102.0.0.0.62.102
       INY                  AND #223      .102.62.6.124.0.0.0
       CPY #240             STA CTRREG           .BYTE
       BNE INL160           LDA #0        0.0.0.0.0.126.24.24.24.24.24.24.0.0.0.
       LDA SC3              STA V+21   ;SPRITE CTRRG  60.6.62.102.62.0.0.0
       CLC                  ADDR SA3.1334        .BYTE
       ADC #64              LDX #9        124.102.96.96.96.0.0.0.62.102.102.62.6
       STA SC3       INL200 LDY #6        .124.0.0.60.102.126
       LDA SC4              LDA #177             .BYTE
       ADC #1        INL210 STA (SA3).Y   96.60.0.0.24.126.24.24.24.14.0.0.0.0.0
       STA SC4              DEY           .0.0.0.0.126.24.24.24
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         *=57344                    ASL A        ;LINE*16          CLC                          BCS  LET300
         .OPT NOL                   BCC  LET040                    ADC  209                     LDX  HOLDA    ;START LINE
;F1 TOGGLE SIZE (1X. 2X)            INC  HOLDA                     STA  209                     JSR  BYTE2    ;LAST LINE
;F2 SET CURSOR (X.Y NEXT 4 BYTES)   LET040 ASL HOLDA               LDA  210                     BCS  LET300
;F3 SPECIAL INSTRUCTIONS            ASL A        ;LINE*32          ADC  #0                      TXA
;  BIT 0 SET:BLANK SCREEN           BCC  LET050                    STA  210                     TAY
;  BIT 0 CLR:UNBLANK SCREEN         INC  HOLDA                     DEY                          LDA  #(8192
;  BIT 1 SET:ENTER TEXT MODE        LET050 ASL HOLDA               BNE  MUL5                    STA  SFD
;  BIT 1 CLR:ENTER GRAPHICS MODE    ASL A        ;LINE*64          LET150 JMP LET590             LDA  #)8192
;  BIT 2 SET:SET UPPER CASE MODE    BCC  LET060                    LET160 CMP #134  ;F3-SPCINSTR STA  SFE
;  BIT 2 CLR:NO CHANGE              INC  SFE                       BEQ  LET170                  CPY  #0
;  BIT 3 SET:SET LOWER CASE MODE    LET060 STA SFD   ;LINE*320     JMP  LET310                  BEQ  LET260
;  BIT 3 CLR:NO CHANGE              LDA  HOLDA                     LET170 JSR BYTE2              CPY  #25
;F5 SCREEN COLOR (IN NEXT 2 BYTES)  CLC                            BCC  LET180                  BCS  LET290
;F6 BORDER COLOR (IN NEXT 2 BYTES)  ADC  SFE                       JMP  LET700                  LET250 LDA SFD
;F7 CHARACTER COLOR (NEXT 2 BYTES)  STA  SFE                       LET180 LDA 1     ;VIC CHIP    CLC
;F8 RETURN                          LDA  211      ;COLUMN          ORA  #4      ;BACK IN FOR     ADC  #(320
CODE1 =16376                        ASL A        ;COLUMN*2         STA  1       ;A SECOND        STA  SFD
CODE2 =16377                        ASL A        ;COLUMN*4         LDA  HOLDA                   LDA  SFE
COLOR =16378                        ASL A        ;COLUMN*8         AND  #1                      ADC  #)320
FLAGS =16379                        BCC  LET070                    BEQ  LET190                  STA  SFE
HOLDA =16380                        INC  SFE                       LDA  53265    ;BLANK SCRN     DEY
HOLDY =16382                        CLC                            AND  #239                    BNE  LET250
LENSTR =16383                       LET070 ADC SFD                 STA  53265    ;SCREEN        LET260 LDY #0
         .MAC ADDR                  STA  SFD      ;L*320+C*8       JMP  LET200                  LDA  #0
         LDA #(?2                   LDA  SFE                       LET190 LDA 53265  ;UNBLANK    LET270 STA (SFD).Y
         STA ?1                     ADC  #32      ;+8192           ORA  #16      ;SCREEN        INY
         LDA #)?2                   STA  SFE                       STA  53265                   BNE  LET270
         STA ?1+1                   LET080 LDA (SA3).Y             LET200 LDA HOLDA             INC  SFE
         .MND                       STY  HOLDY                     AND  #2                      LET280 STA (SFD).Y
         .MAC DINC                  CMP  #142    ;SET 1           BEQ  LET210                  INY
         INC ?1                     BNE  LET090                    LDA  53265    ;SET           CPY  #64
         BNE ?2                     LDA  FLAGS                     AND  #223    ;TEXT           BCC  LET280
         INC ?1+1                   AND  #251                      STA  53265    ;MODE          LDA  SFD
?2       .MND                       STA  FLAGS                     LDA  53272                   CLC
         JMP LETERS                 JMP  LET690                    AND  #247                    ADC  #64
         JMP LETML                  LET090 CMP #14   ;SET 2        STA  53272                   STA  SFD
LETERS LDA 71                       BNE  LET100                    JMP  LET220                  LDA  SFE
         STA SFD                    LDA  FLAGS                     LET210 LDA 53265  ;SET        ADC  #0
         LDA 72                     ORA  #4                        ORA  #32     ;BIT MAP        STA  SFE
         STA SFE                    STA  FLAGS                     STA  53265    ;MODE          INX
         LDY #0                     JMP  LET690                    LDA  53272                   CPX  #25
         LDA (SFD).Y  ;LENGTH OF    LET100 CMP #133  ;F1-ENLARGE   ORA  #8                      BCS  LET290
         BNE LET010   ; STRING      BNE  LET110  ;OR              STA  53272                   CPX  HOLDA
         RTS                        LDA  FLAGS    ;NORMAL          LET220 LDA HOLDA             BCC  LET260
LET010 STA LENSTR                   EOR  #1                        AND  #4                      BEQ  LET260
         INY                        STA  FLAGS                     BEQ  LET230                  LET290 JMP LET690
         LDA (SFD).Y  ;ADDRESS OF   JMP  LET690                    LDA  53272    ;SET UPPER     LET300 JMP LET700
         STA SA3      ; STRING NOW  LET110 CMP #137  ;F2-CURSOR    AND  #253    ;CASE           JMP  LET690
         INY          ; IN SA3 AND  BNE  LET150                    STA  53272                   LET310 CMP #18   ;REVERSE
         LDA (SFD).Y  ; SA4         JSR  BYTE2                     LDA  FLAGS                   BNE  LET320   ;ON
         STA SA4      ; ---         BCC  LET130                    AND  #251                    LDA  FLAGS
LETML LDY #0                        LET120 JMP LET700              STA  FLAGS                   ORA  #2
         STY FLAGS    ;CLEAR FLAGS  LET130 CMP #40                 LET230 LDA HOLDA             STA  FLAGS
         LDA 53272    ;WHICH SET?   BCS  LET140                    AND  #8                      JMP  LET690
         AND #2                     STA  211      ;X              BEQ  LET240                  LET320 CMP #146  ;REVERSE
         BEQ LET020   ;SET 1        LET140 JSR BYTE2               LDA  53272    ;SET LOWER     BNE  LET330   ;OFF
         LDA #4       ;SET 2        BCS  LET120                    ORA  #2      ;CASE           LDA  FLAGS
         STA FLAGS                  CMP  #25                       STA  53272                   AND  #253
LET020 LDA 1         ;SWITCH IN     BCS  LET150                    LDA  FLAGS                   STA  FLAGS
         AND #251     ; CHARACTER   STA  214                       ORA  #4                      JMP  LET690
         STA 1        ; ROM         LDY  #4                        STA  FLAGS                   LET330 CMP #138  ;F4-ARROWS
LET030 LDA #0                       STY  210                       LET240 LDA 1     ;VIC CHIP    BNE  LET360
         STA HOLDA                  ASL  A                         AND  #251    ;OUT AGAIN      JSR  BYTE2
         LDA 214      ;LINE NUMBER  ASL  A                         STA  1                       BCC  LET350
         STA SFE      ;LINE*256     ASL  A                         LDA  HOLDA    ;CLEAR PART     LET340 JMP LET700
         ASL A        ;LINE*2       STA  HOLDA                     AND  #16     ; OF SCREEN?     LET350 SEC
         ASL A        ;LINE*4       STA  209                       BEQ  LET290                  SBC  #1
         ASL A        ;LINE*8       MUL5 LDA HOLDA                 JSR  BYTE2                   CMP  #8
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        BC    LET340
        ASL   A
        ASL   A
        ASL   A
        CLC
        ADC   #<ARROWS
        STA   $FB
        LDA   #>ARROWS
        ADC   #0
        STA   $FC
        JMP   LET610
LET360  CMP   #135        ;F5-COLOR
        BNE   LET380
        JSR   BYTE2
        BCC   LET370
        JMP   LET700
LET370  LDA   #240
        STA   CODE1
        JSR   ADJSCR
        JMP   LET690
LET380  CMP   #139        ;F6-BORDER
        BNE   LET400      ;COLOR
        JSR   BYTE2
        BCC   LET390
        JMP   LET700
LET390  TAX
        LDA   1           ;SWITCH IN
        ORA   #4          ; VIC CHIP
        STA   1           ; A SECOND
        STX   53280       ;BORDER
        LDA   1           ;SWITCH OUT
        AND   #251        ; VIC CHIP
        STA   1           ; AGAIN
        JMP   LET690
LET400  CMP   #147        ;CLEAR SCRN
        BNE   LET430
        LDA   #<8192
        STA   $FD
        LDA   #>8192
        STA   $FE
        LDY   #0
LET410  LDA   #0
        STA   ($FD).Y
        DINC  $FD
        LDA   $FD
        CMP   #<16192
        BNE   LET410
        LDA   $FE
        CMP   #>16192
        BNE   LET410
LET420  LDA   #>1024
        STA   210
        LDA   #0
        STA   209
        STA   211
        STA   214
        JMP   LET690
LET430  CMP   #29         ;RIGHT ARROW
        BNE   LET440
        JSR   TLINE
        JMP   LET690
LET440  CMP   #17         ;DOWN ARROW
        BNE   LET450
        JSR   LET710
SKIP    JMP   LET690
LET450  CMP   #145        ;UP ARROW
        BNE   LET460
        LDA   FLAGS
        AND   #1

        STA   $FF
BIG1    LDA   214
        BEQ   SKIP
        DEC   214
        LDA   209
        SEC
        SBC   #40
        STA   209
        LDA   210
        SBC   #0
        STA   210
        DEC   $FF
        BEQ   BIG1
        JMP   LET690
LET460  CMP   #157        ;LEFT ARROW
        BNE   LET480
        LDA   FLAGS
        AND   #1
        STA   $FF
BIG2    LDA   211
        BNE   LET470
        LDA   214
        BEQ   SKIP
        DEC   214
        LDA   #40
        STA   211
        LDA   209
        SEC
        SBC   #40
        STA   209
        LDA   210
        SBC   #0
        STA   210
LET470  DEC   211
        DEC   $FF
        BEQ   BIG2
        JMP   LET690
LET480  CMP   #13
        BNE   LET500
LET490  LDA   #40
        STA   211
        JSR   TLINE
        JMP   LET690
LET500  CMP   #136        ;F7-CHAR COL
        BNE   LET520
        JSR   BYTE2
        BCC   LET510
        JMP   LET700
LET510  LDA   #15
        STA   CODE1
        LDA   HOLDA
        ASL   A
        ASL   A
        ASL   A
        ASL   A
        STA   HOLDA
        JSR   ADJSCR
        JMP   LET690
LET520  CMP   #140        ;F8-RETURN
        BEQ   LET490
        CMP   #19         ;HOME
        BNE   LET530
        JMP   LET420
LET530  LDX   #0
LET540  LDA   SPCIAL,X
        BEQ   LET560
        CMP   ($A3).Y
        BEQ   LET550
        INX

        INX
        JMP   LET540
LET550  INX
        LDA   SPCIAL,X
        STA   646
        JMP   LET690
LET560  LDA   ($A3).Y
        CMP   #96
        BCS   LET570
        AND   #191        ;X<96
        JMP   LET590
LET570  CMP   #161
        BCS   LET580
        AND   #223        ;96<X<161
        JMP   LET590
LET580  AND   #127        ;161<X<256
        ORA   #64
LET590  STA   $FB
        LDA   #0
        STA   $FC
        LDX   #3          ;*8
LET600  ASL   $FB
        ROL   $FC
        DEX
        BNE   LET600
        LDA   $FC
        CLC
        ADC   #$D0
        STA   $FC
        LDA   FLAGS       ;WHICH SET?
        AND   #4
        BEQ   LET610      ;SET 1
        LDA   $FC         ;SET 2
        CLC
        ADC   #8
        STA   $FC
LET610  LDA   209
        CLC
        ADC   211
        STA   SC3
        LDA   210
        ADC   #0
        STA   SC4
        LDX   #8
        LDA   646
        ASL   A
        ASL   A
        ASL   A
        ASL   A
        STA   COLOR
LET620  LDY   #0
        LDA   ($FB).Y     ;CLEARS
        STA   HOLDA
        LDA   FLAGS
        BEQ   LET640
        AND   #1
        BEQ   LET630
        JSR   DOUBLE
LET630  LDA   FLAGS
        AND   #2
        BEQ   LET640
        LDA   HOLDA
        EOR   #255
        STA   HOLDA
        LDA   HOLDA+1
        EOR   #255
        STA   HOLDA+1
LET640  LDA   HOLDA
        STA   ($FD).Y     ;BIT MAP

        LDA   ($C3).Y     ;COLOR
        AND   #15
        ORA   COLOR
        STA   ($C3).Y
        LDA   FLAGS
        AND   #1
        BEQ   LET650
        LDA   214
        CMP   #24
        BEQ   LET650
        INY
        LDA   HOLDA
        STA   ($FD).Y
        LDA   ($C3).Y     ;COLOR
        AND   #15
        ORA   COLOR
        STA   ($C3).Y
        LDY   #40
        STA   ($C3).Y
        INY
        STA   ($C3).Y
        LDY   #8
        LDA   HOLDA+1
        STA   ($FD).Y
        INY
        STA   ($FD).Y
        DINC  $FB
        DINC  $FD
        DINC  $FD
        DEX
        BNE   LET650
        INC   211
        DEC   $FE
        LDA   $FD
        SEC
        SBC   #64
        STA   $FD
        LDA   $FE
        SBC   #0
        STA   $FE
        JMP   LET680
LET650  CPX   #4
        BNE   LET670
        LDA   $FD
        CLC
        ADC   #56
        STA   $FD
        LDA   $FE
        ADC   #1
        STA   $FE
        JMP   LET620
LET660  DINC  $FD         ;BIT MAP
        DINC  $FB         ;CHARS
        DEX
        BEQ   LET680
LET670  JMP   LET620
LET680  JSR   TLINE
LET690  LDY   HOLDY
        INY
        DEC   LENSTR
        BEQ   LET700
        JMP   LET030
LET700  RTS
TLINE   INC   211
        LDA   211
        CMP   #40
        BCC   LET730
        LDA   #0
        STA   211
```

```
LET710 LDA   FLAGS                          RTS
       AND   #1               BYTE2 JSR   UPDATE
       STA   $FF                    BCS   BYL20
LET720 LDA   214                    SEC
       CMP   #24                    SBC   #'0
       BEQ   LET730                 ASL   A
       INC   214                    STA   HOLDA
       LDA   209                    LDY   #4
       CLC                    BYL10 CLC
       ADC   #40                    ADC   HOLDA
       STA   209                    DEY
       LDA   210                    BNE   BYL10
       ADC   #0                     STA   HOLDA
       STA   210                    JSR   UPDATE
       DEC   $FF                    BCS   BYL20
       BEQ   LET720                 SEC
LET730 RTS                          SBC   #'0
ADJSCR LDY   #<1024                 CLC
       STY   $FD                    ADC   HOLDA
       LDY   #>1024                 STA   HOLDA
       STY   $FE                    CLC
ADJ01  LDY   #0               BYL20 RTS
       LDA   ($FD),Y          UPDATE LDY   HOLDY
       AND   CODE1                  INY
       ORA   HOLDA                  DEC   LENSTR
       STA   ($FD),Y                BNE   UP10
       DINC  $FD                    SEC
       LDY   $FD                    RTS
       CPY   #<2024           UP10  LDA   (SA3),Y
       BNE   ADJ01                  STY   HOLDY
       LDY   $FE                    CLC
       CPY   #>2024                 RTS
       BNE   ADJ01                  .OPT  NOL
       RTS                    SPCIAL .BYTE
DOUBLE TXA                    144.0.5.1.28.2.159.3.156.4.30.5.31.6
       PHA                          .BYTE
       LDA   HOLDA            158.7.129.8.149.9.150.10.151.11.152.12
       LDX   #0                      .BYTE 153.13.154.14.155.15.0.0
       STX   HOLDA            ARROWS .BYTE
       STX   HOLDA+1          0.24.60.126.24.24.24.24.0.24.120.56.10
       TAX                    4.96.192.192
       LDA   #128                   .BYTE
       STA   CODE1            0.4.6.255.255.6.4.0.0.192.192.96.104.5
       LDA   #192             5.120.24
       STA   CODE2                   .BYTE
DBL1   TXA                    0.24.24.24.24.126.60.24.0.3.3.6.22.28.
       AND   CODE1            30.24
       BEQ   DBL2                    .BYTE
       LDA   CODE2            0.32.96.255.255.96.32.0.0.24.30.??.22.
       ORA   HOLDA            6.3.3
       STA   HOLDA                   .OPT  LIST
DBL2   LSR   CODE1                   .END
       LSR   CODE2
       LSR   CODE2
       BNE   DBL1
       LDA   #192
       STA   CODE2
DBL3   TXA
       AND   CODE1
       BEQ   DBL4
       LDA   CODE2
       ORA   HOLDA+1
       STA   HOLDA+1
DBL4   LSR   CODE2
       LSR   CODE2
       LSR   CODE1
       BNE   DBL3
       PLA
       TAX
```

```
10 POKE 808,237:V=53248:POKE 53281,0:POKE V+21,0:POKE V+38,0:POKE 893,0
20 BS=" ":LS=0:NU=0:WI=0:I1=44152:I2=44496:RN=40:CH=3:C=2
30 DIM SD(3,36),H%(8),D1%(10,6),D2%(10,5),DS$(2,4),CRS(5),CR%(3),LV% (11)
40 DEF FNH(X)=INT(X/256):DEF FNL(X)=X-INT(X/256)*256
50 DEF FNW(X)=PEEK(X)+PEEK(X+1)*256:DEF FNZ(X)=INT((ABS(X)>0)*X)+.5)
60 EN=3200:DS=3203:RT=3206:BANG=3212:WH=3215:SC=3221:SV=3224
70 CO=3227:HM=3230:MA=3233:TK=3239:GP=3242
80 FOR I=0 TO 10:LV%(I)=I:NEXT I:LV%(11)=-1
90 IF PEEK(56321)=127 THEN SYS DS:GOSUB 3350:GOTO 140
100 IF PEEK(56321)=247 THEN POKE 53280,0:SYS DS:GOTO 140
110 GET A$:IF A$="" THEN 90
120 BS=RIGHT$(BS,1)+A$:Z=-(BS="lp"):IF Z=0 THEN 90
130 SYS DS:POKE 53265,27:POKE 53272,23:PRINT"[CLR]"::POKE 49161,2:SYS 49179
140 A$="[F3][09][F6][00][F5][00][F7][00][CLR][LBLU][F2]0500[F1]The [RED]MACS Moving[F2]0102Target Program[L5LU] will"
150 A$=A$+"[F2]0004give instruction and[F2]0806practice on:[F8]"
160 A$=A$+"[GRN][F1]. [F1]How to lead moving  targets[F8][F1]. [F1]A single lead rule[F8]"
170 A$=A$+"[F1]. [F1]Tracking targets[F8][F1]. [F1]Trapping targets[F8]"
180 A$=A$+"[F1]. [F1]Engaging multiple[F8] targets[LGRN][F3]00":GOSUB 3000:AS '
190 FOR I=1 TO 10:FOR J=0 TO 6:READ D1%(I,J):NEXT J,I
200 FOR I=0 TO 2:FOR J=0 TO 4:READ DS$(I,J):NEXT J,I
210 FOR I=1 TO 5:READ CRS(I):NEXT I:GOSUB 3170
212 A$="[F3][09][F1][CLR][LBLU][F2]0101This program may be[F2]0003fired with [Gun    scope[LBLU][F2]0505"
213 A$=A$+"or [GRN]iron sights.[RED][F2]0708Are you using[F2]0610the [GRN]telescope?[F3]08"
214 GOSUB 3000:SB=15:GOSUB 5440:I=(PEEK(2774)=255):IF 2-I=0 THEN 220
215 FOR I=2752 TO 2815:Z=PEEK(I+384):POKE I+384,PEEK(I):POKE I,Z:NEXT I
220 A$="[F3][09][F5][00][F7][00][CLR][GRN][F2]0702[F1]MOVING TARGET[F2]0404TRAINING PROGRAM[LBLU][F8][F1][F8] . Zeroing[F8]"
230 A$=A$+" .  Instruction and Demonstration[F8][F8][F2]0199[GRN]Levels:[LBLU][F8]":GOSUB3000:AS="[LGRN]"
240 POKE 253,1:POKE 254,10:POKE 823,0:SB=3:GOSUB 5430:GOSUB 3170
250 POKE 929,0:LS=0:CL=0:GOSUB 1000:LS=1:CL=LV%(LS):POKE 929,WI
260 GOSUB 3220:BC=BL:CL=LV%(LS):IF LS=0 THEN 250
270 ON CL GOSUB 1440,1440,2070,2070,2070,2070,2450,2630,2630,2630
280 IF LV%(LS)<>-1 THEN 260
290 A$="[F3][09][F6]05[CLR][F5]05[F7]05[BLK][F2]0502[F1]CONGRATULATIONS[F8][F8]  You are finished[F8]  with this "
300 A$=A$+"program.[F8][F8]  Call instructor.[F1][F2]0823Pull trigger to continue[F3]00"
310 GOSUB 3000:LS=0:POKE 198,0:RESTORE:GOTO 90
1000 H%(0)=0:S1=32768:S2=3:TA=5:ME=0:POKE 940,160:POKE 942,100
1010 A$="[F3][09][F6][00][F5]13[F7][00][CLR][BLK][F1][F2]0701First 3 shots[F2]0503establish zero."
1020 A$=A$+"[F2]0105Aim center of mass.[F2]0517White dot shows[F2]1319center.":GOSUB3000
1030 POKE 880,3:SB=24:GOSUB 5430:FOR Z=12196 TO 12199:POKE Z,15:NEXT Z
1040 POKE 1524,1:A$="[F2]0723<Pull trigger to continue>[F3]00":GOSUB 3000
1050 IF PEEK(56321)=247 THEN 1080
1060 GET A$:IF A$<>"@" THEN 1050
1070 TN=-1
1080 GOSUB 3200:IF WI=0 THEN 1110
1090 A$="[F3][09][F5][00][F7][00][F1][GRN][F2]0904There is no[F2]0607wind while you[F2]0410are establishing"
1100 A$=A$+"[F2]0913shot group.[LGRN][F1]":GOSUB 3160
1110 BC=0:POKE 899,42:POKE 883,60:FOR Z=834 TO 837:POKE Z,0:NEXT Z
1120 OX=0:OY=0:POKE 838,0:POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180
1130 POKE 823,0:POKE 824,0:POKE 821,17:POKE 822,0:SB=9:GOSUB5430:GOSUB 3200:S=0
1140 IF (S<>0) AND (S<>3) THEN 1180
1150 FOR Z=0 TO 3:SD(Z,36)=0:NEXT Z:PS=INT(S/3)
1160 A$="[F3][09][CLR][F6][00][F5][00][F1][WHT][F2]1209ASSUME A[F2]1112SUPPORTED[F2]1215POSITION[F1]"
1170 GOSUB 3160:GOSUB 3010
1180 POKE 876,0:POKE 877,204:X=((INT(RND(1)*75))*2)+71:IF TN THEN X=165
1190 POKE 52225,X:GOSUB 3200:POKE 933,0
1200 Z=-20352:SB=0:GOSUB 5440:POKE V+21,0:IF Z=128 THEN 1180
1210 N=FNW(907):N=N+(N>128)*(N-128):GOSUB 3020
1220 IF S>2 THEN 1250
1230 X1=(X+11)-FNW(847):Y1=165-FNW(849):OX=OX+X1:OY=OY+Y1:SD(1,S)=2
1240 IF (X1>73) OR (X1<-148) OR (Y1>17) OR (Y1<-47) THEN BC=1
1250 SD(0,36)=SD(0,36)+SD(0,S):SD(2,36)=SD(2,36)+SD(2,S)
1260 GOSUB 3200:IF S<>2 THEN 1410
1270 BC=0:IF BC=0 THEN 1330
1280 A$="[F3][09][CLR][RED][F5][00][F7][00][F1][F2]0204Invalid shot group[F2]1107try again":IF H%(0)=0 THEN1300
1290 A$=A$+"[F2]0310or check lightpen[F2]0513mount alignment[F2]0816(see manual)"
1300 A$=A$+"[F1][LGRN]":H%(0)=1:GOSUB 3170
1310 IF BR THEN Z=1:GOTO 130
1320 GOTO 1110
1330 OX=INT((OX/3)+1):OX=INT(OX/2)*2:X=OX-(OX<0)*65536
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1340 OY=INT((OY/3)+0.5):Y=OY-(OY<0)*65536
1350 POKE 834,FNL(X):POKE 835,FNH(X):POKE 836,FNL(Y):POKE 837,FNH(Y)
1360 SD(1,0)=SD(1,0):SYS 3236:FOR Z=0 TO 2:SD(1,36)=SD(1,36)+SD(1,Z)
1370 SD(3,36)=SD(3,36)+SD(3,Z):NEXT Z:Z=I1:GOSUB 4740:IF CRS=CRS(5) THEN 1410
1380 A$="[F3]05[CLR][F5]00[F7]00[F1][WHT]shot group"+CRS+"[SWLC][LBLU][F2]0304Would you like to[F2]1107try for a"
1390 A$=A$+"[F2]0810better zero?[F3]08"
1400 GOSUB 3000:SB=15:GOSUB 5440:POKE 53265,43:IF Z THEN 1110
1410 S=S+1:IF S<3 THEN 1140
1420 SB=0:GOSUB 5460
1430 RETURN
1440 IF CL=2 THEN 1490
1450 Z=0:SB=3:GOSUB 5470:SB=6:Z=1:GOSUB 5470
1460 A$="[F3]09[CLR][F5]00[F7]00[F1][GRN][F2]0203Use the non-firing"
1470 A$=A$+"[F2]0406hand as a pivot.[F2]0209Smoothly track the[F2]0412target by moving"
1480 A$=A$+"[F2]0415your upper body.[F1][LGRN]":GOSUB 3170:GOTO 1500
1490 Z=1:SB=3:GOSUB 5470:SB=6:Z=2:GOSUB 5470
1500 A$="[F3]09[CLR][F1][GRN][F2]100110 targets[F2]0105Feedback after each[F2]1507shot.[F2]1111Standard:"
1510 IF CL=2 THEN 1540
1520 A$=A$+"[F2]0413Smooth track and[F2]0615proper lead on[F2]06173 of 5 targets"
1530 GOTO 1550
1540 A$=A$+"[F2]0313Apply proper trap[F2]0715lead for 3 of[F2]11175 targets"
1550 A$=A$+"[F2]0219in each direction.[F1]":GOSUB 3160:TN=8:TA=18
1560 POKE 53265,43:POKE 876,0:POKE 877,204:POKE 883,200:POKE 838,0
1570 AD=16325:FOR I=0 TO 4:POKE AD,4:AD=AD+1:NEXT I
1580 FOR I=0 TO 4:POKE AD,16:AD=AD+1:NEXT I
1599 POKE AD,255:POKE 823,18:POKE 824,0:POKE 821,0:SB=6:GOSUB 5430
1600 POKE 899,42:NV=-1:S1=32768:S2=3:IR=-32640:GOSUB 5360:GOSUB 5370
1610 H=0:RP=0:GOSUB 3070:POKE 53280,0:Z=0
1620 S=PEEK(838):POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180:POKE 900,255
1630 GOSUB 3010:A$="L="+STR$(CL)+"]T="+STR$(S+1)+"]R="+STR$(RP)
1640 GOSUB 5230:AD=FNW(876):PO=6:TF=PEEK(AD+9)*2
1650 IF PEEK(AD+8)>127 THEN TF=-TF:PO=-PO
1660 Y=PEEK(AD+2):TJ=PEEK(AD+11):TJ=TJ+(TJ>127)*256:POKE I2+,+S*8,RP
1670 GOSUB 4020:POKE 933,128
1680 Z=IR:SB=0:GOSUB 5440:POKE 878,0:IF Z=128 THEN POKE V+21,0:GOTO 2060
1690 IF PEEK(900)=255 THEN SYS WH:GOTO 1810
1700 A$="miss":IF PEEK(900)<128 THEN A$="hit"
1710 A$="[F2]0123[F1][BLK]  "D$(1,2)+A$:GOSUB 3000
1720 GOSUB 4040:IF Z=128 THEN
1730 IF (CR%(0)>3) AND (ME=CL) THEN H=H+1
1740 IF (CR%(1)>3) AND (ME=CL) THEN H=H+16
1750 IF ME=CL THEN 1820
1760 B$="tracked":IF ME=2 THEN B$="trapped"
1770 A$="[F3]09[CLR][F5]00[F7]00[F1][F2]0204[GRN]On the last target[F2]0007you [RED]"+B$+"[GRN].  Try to[F2]0210[RED]"
1780 B$="[C/RT]trap":IF ME=2 THEN B$="track"
1790 A$=A$+B$+"[GRN] every target[F2]0013for the rest of this"
1800 A$=A$+"[F2]0216practice exercise.[F1]":GOSUB 3160
1810 POKE 838,S:Z=FNW(876)-17:POKE 876,FNL(Z):POKE 877,FNH(Z):GOTO 1620
1820 S=S+1:POKE 838,S:IF S/5<>INT(S/5) THEN 1620
1830 N=5:Z=I1+H%(1)*8:24=1:GOSUB 4500
1840 A$="[F3]09[F6]00[F5]00[F7]00[CLR][LBLU][SWLC][F1][F2]1303Summary"+"[GRN][F2]0306Standard: Good or"
1850 IF CL=2 THEN 1890
1860 A$=A$+"[F2]0108Excellent Track and[F2]0610lead on 3 of 5"
1870 A$=A$+"[F2]1212targets.[F2]0915Your Score:[F2]0017Smooth Track:"
1880 A$=A$+STR$(H AND 15)+" of 5[F2]0819Lead:"+STR$(INT(H/16))+" of 5[F1][LGRN]":GOTO 1910
1890 A$=A$+"[F2]0308Excellent lead on[F2]05103 of 5 targets.[F2]0913Your Score:[F2]1215"
1900 A$=A$+STR$(INT(H/16))+" of 5[F1][LGRN]"
1910 GOSUB 3170
1920 IF (((H AND 15)>2) OR (CL=2)) AND (INT(H/16)>2) THEN 2050
1930 GOSUB 3090:A$="[F3]09[F6]00[F5]00[F7]00[CLR][RED][SWLC][F1][F2]0407You did not meet[F2]0710the standard."
1940 A$=A$+"[F2]0213Prepare to refire.[F1][LGRN]":GOSUB 3170:BC=2
1950 IR=-31616:RP=RP+1:A$="[F3]09[F6]00[F5]00[F7]00[CLR][GRN][SWLC][F1]"
1960 IF CL<>1 THEN 2010
1970 A$=A$+"[F2]0102For a smooth track,[F2]0204move your rifle at"
1980 A$=A$+"[F2]0306the same speed as[F2]0208the target, trying"
1990 A$=A$+"[F2]0010to keep the trailing[F2]0412tip of the front"
2000 A$=A$+"[F2]0014sight post at target[F2]0516center of mass.[F1]":GOTO 2040
2010 A$=A$+"[F2]0202To [RED]trap[GRN], aim ahead[F2]0105and wait for target"
2020 A$=A$+"[F2]0008center mass to reach[F2]0111the nearest edge of"
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2030 A$=A$+"|F2|0514the front sight|F2|1517post.|F1|"
2040 H=0:GOSUB 3160:GOTO 1620
2050 IR=-32640:BC=BL:TA=TA+1:IF S<10 THEN 1610
2060 LS=LS-(Z<>128):RETURN
2070 IF CL<>3 THEN 2110
2080 Z=3:SB=6:GOSUB 5470:A$="|F3|09|CLR||F5|00|F7|00|F1||F8||F8||GRN|You may either track"
2090 A$=A$+"or trap targets, but|C/RT|in harder exercises|F8|many shooters find a"
2100 A$=A$+"  |C/RT|mixture of both|F8||C/RT|methods works best.|F1||LGRN|":GOSUB 3170
2110 A$="|F3|09|CLR||F5|00|F7|00|F1||LBLU||F2|100118 targets|F2|0105Feedback after each|F2|1607shot"
2120 A$=A$+"|F2|1111Standard:|F2|0213Hit 2 of 3 targets|F2|0715at each speed"
2130 A$=A$+"|F2|0717and direction|F1|":GOSUB 3160
2140 TN=CL+4:POKE 53265,43:POKE 876,0:POKE 877,204:POKE 883,200:POKE 838,0
2150 AD=16325:Z=(CL-3)*3:FOR I=0 TO 5
2160 FOR J=0 TO 2:POKE AD,Z+INT(I/2)+((I/2)-INT(I/2))*24:AD=AD+1:NEXT J,I
2170 POKE AD,255:POKE 823,18:POKE 824,0:POKE 821,0:SB=6:GOSUB 5430:POKE 899,42
2180 MV=-1:S1=32768:S2=3:IR=-32640:TA=(CL-2)*8-1:GOSUB 5360:GOSUB 5370
2190 FOR Z=0 TO 4:D2%(Z,0)=0:D2%(Z,1)=0:NEXT Z
2200 H=0:TA=TA+1:RP=0:GOSUB 3070:POKE 53280,0:Z=0:IF TA>(CL-1)*8-3 THEN 2440
2210 FOR Z=0 TO 4:D2%(Z,2)=0:D2%(Z,3)=0:NEXT Z
2220 POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180:POKE 900,255
2230 S=PEEK(838):GOSUB 3010:A$="L="+STR$(CL)+"|T="+STR$(S+1)+"|R="+STR$(RP)
2240 GOSUB 5230:AD=FNW(876)
2250 PO=6:TF=PEEK(AD+9)*2:IF TA>=36 THEN PO=TF:REM 185M 6 MPH
2260 IF PEEK(AD+8)>127 THEN TF=-TF:PO=-PO
2270 Y=PEEK(AD+2):TJ=PEEK(AD+11):TJ=TJ+(TJ>127)*256:POKE I2+7+S*8,RP
2280 GOSUB 4020:POKE 933,128
2290 Z=IR:SB=0:GOSUB 5440:POKE 878,0
2295 IF Z=128 THEN POKE V+21,0:GOSUB 4845:GOTO 2440
2300 IF PEEK(900)=255 THEN SYS WH:GOTO 2370
2310 A$="miss":IF PEEK(900)<128 THEN A$="hit"
2320 A$="|F2|0123|F1||BLK|"+CHR$(142)+A$:GOSUB 3000
2330 IF PEEK(900)=255 THEN POKE 907,PEEK(829):POKE 908,PEEK(830)
2340 IF PEEK(900)<128 THEN H=H+1
2350 GOSUB 4040:FOR I=0 TO 3:D2%(I,1+ME)=D2%(I,1+ME)+CR%(I):NEXT I
2360 D2%(4,1+ME)=D2%(4,1+ME)+1:IF Z=128 THEN GOSUB 4845:GOTO 2440
2370 S=S+1:POKE 838,S:IF S/3<>INT(S/3) THEN 2220
2380 N=3:Z=I1+H%(1)*8:Z4=1:GOSUB 4500
2390 IF H>1 THEN 2420
2400 GOSUB 3090:IR=-31616:RP=RP+1:H=0:AD=I1+PEEK(838)*8
2410 FOR Z=0 TO 2:POKE AD,255:AD=AD+8:NEXT Z:GOSUB 5210:GOTO 2210
2420 GOSUB 4845:IR=-32640:BC=BL:GOTO 2200
2440 A=Z:GOSUB 4850:LS=LS-(A<>128):RETURN
2450 Z=3:SB=6:GOSUB 5470:A$="|F3|09|CLR||F5|00|F7|00|F1||LBLU||F2|040336 timed targets|F2|1007Replay for"
2460 A$=A$+"|F2|0909misses only|F2|1113Standard:|F2|0115Hit 8/12 stationary"
2470 A$=A$+"|F2|0417Hit 16/24 moving|F1|":GOSUB 3160:RP=0
2480 POKE 53265,43:GOSUB 5370:B=0:E=35:Z=B*256+E:SB=21:GOSUB 5440
2490 IR=(CH=0)*32640+(CH=1)*30592+(CH=2)*28544+(CH=3)*32640
2500 FOR Z=B TO E:Z1=PEEK(16325+Z):IF Z1>29 THEN POKE 16325+Z,Z1-6
2510 NEXT Z:POKE 821,0:POKE 823,18:POKE 824,0:SB=6:GOSUB 5430:S1=37445
2520 S2=3:GOSUB 5360:FOR Z=1 TO 10:FOR Z1=0 TO 2:D2%(Z,Z1)=0:NEXT Z1,Z
2530 I=0:POKE 876,0:POKE 877,204:POKE 883,200:POKE 933,128:Z=32
2540 I=I+1:IF I>36 THEN F=-1:GOTO 2590
2550 IF Z=32 THEN GOSUB 3010
2560 GOSUB 4580:POKE V+21,0:IF Z=128 THEN 2590
2570 IF Z=64 THEN SYS WH
2580 GOTO 2540
2590 A=-2*(Z=128):POKE 53265,43:N=PEEK(838):IF N=0 THEN 2610
2600 POKE 838,36:A$="|F6|00|CLR||F5|00|F7|00|LBLU||SWLC||F2|1201Summary: Level 7":GOSUB 5000
2610 IF A=0 THEN GOSUB 5210:RP=RP+1:GOTO 2480
2620 LS=LS+(A AND 1):RETURN
2630 IF CL<>9 THEN 2670
2640 A$="|F3|09|CLR||F5|00|F7|00|F1||LBLU||F2|100340 targets|F2|110740 rounds"
2650 A$=A$+"|F2|1111Standard:|F2|0013Hit 10/14 stationary|F2|0415Hit 20/26 moving|F1|"
2660 GOTO 2690
2670 A$="|F3|09|CLR||F5|00|F7|00|F1||LBLU||F2|100330 targets|F2|0907"+STR$(RN)+" rounds"
2680 A$=A$+"|F2|1111Standard:|F2|0113Hit 7/10 stationary|F2|0415Hit 15/20 moving|F1|"
2690 GOSUB 3160:RP=0:Z=RN+(CL=9)*(RN-40):POKE 899,2
2700 POKE 53265,43:GOSUB 5360:GOSUB5370
2710 IF CH=3 THEN IR=-(CL=8)*2688-(CL>8)*4736:GOTO 2730
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2720 IR=-(CH=0)*640-(CH=1)*2688-(CH=2)*4736
2730 Z=-(CL=8)*634-(CL=9)*1198-(CL=10)*2011:POKE 823,FNL(Z):POKE 824,FNH(Z)
2740 Z=-(CL=8)*1198-(CL=9)*2011-(CL=10)*2574:POKE 821,FNL(Z):POKE 822,FNH(Z)
2750 SB=9:GOSUB 5430:S1=38042:S2=7:POKE 933,128:POKE 876,0:POKE 877,204
2760 POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180
2770 POKE 838,0:POKE 883,60:POKE 934,0:POKE 935,0
2780 GOSUB 3010:AS="L="+RIGHTS(STRS(CL),2)+"]T=    ]R="+STRS(RP):GOSUB 5230
2790 Z=IR:SB=0:GOSUB 5440:POKE V+21,0:A=-2*(Z=128)
2800 POKE 53265,43:N=PEEK(838):IF N=0 THEN 2820
2810 AS="[F6I00[CLR][F5I00[F7I00[LBLU][SWLC][F2I1201Summary: Level"+STRS(CL):GOSUB 5000
2820 IF A=0 THEN GOSUB 5210:RP=RP+1:GOTO 2700
2830 LS=LS+(A AND 1):RETURN
3000 AS=AS:SYS 49182:RETURN
3010 POKE 253,FNL(S1):POKE 254,FNH(S1):POKE 251,S2:SYS SC:RETURN
3020 SD(0,S)=-1:IF N>6 THEN SD(0,S)=(N-45)*256+(N-7):IF N<45 THEN SD(0,S)=N-7
3030 SD(1,S)=SD(0,S)
3040 SD(2,S)=-1:IF N>5 THEN SD(2,S)=(N-6)*256+(N-1)
3050 POKE 785,FNL(MA):POKE 786,FNH(MA):Z=USR(S)
3060 RETURN
3070 H%(1)=PEEK(838):H%(2)=PEEK(876):H%(3)=PEEK(877):H%(4)=PEEK(889)
3080 H%(5)=PEEK(890):H%(6)=PEEK(891):H%(7)=PEEK(892):H%(8)=PEEK(899):RETURN
3090 POKE 838,H%(1):POKE 876,H%(2):POKE 877,H%(3):POKE 889,H%(4)
3100 POKE 890,H%(5):POKE 891,H%(6):POKE 892,H%(7):POKE 899,H%(8):RETURN
3110 Z4=-(TA>6)*(INT(TA/2)-INT(TA/8)-2):Z5=J-(J>0)-((J=0) AND (ME<>1))
3120 Z=INT(SD(J,S)+.5):POKE 823,Z4:POKE 824,Z5:SB=27:GOSUB 5440
3130 CRS=CRS(Z):CR%(J)=Z:IF (CL<>0) OR (NU=0) THEN RETURN
3140 BS=STRS(39-LEN(STRS(SD(J,S)))):BS=RIGHTS(BS,2)
3150 CRS="[F1][F2]2499"+MIDS(CRS,6,10)+"[F8][F2]"+BS+"99"+STRS(SD(J,S))+"[F8][F1]":RETURN
3160 AS=AS+"[RED][F2]0723<Pull trigger for targets>[F3]00":GOSUB 3000:GOTO 3180
3170 AS=AS+"[F2]0723<Pull trigger to continue>[F3]00":GOSUB 3000
3180 BR=RND(1):BR=0:IF PEEK(56321)=127 THEN BR=-1:GOTO 3200
3190 IF PEEK(56321)<>247 THEN 3180
3200 IF PEEK(56321)<>255 THEN 3200
3210 RETURN
3220 CL=LV%(LS):AS="[F3]09[F6]00[CLR][F5]00[F7]00[F1][LBLU][F2]1505LEVEL[F2]1709":BS=STRS(CL):Z=CL+(CL=10)*10
3230 IF CL=10 THEN BS="[C/RT]10"
3240 AS=AS+BS+"[GRN][F2]0014":GOSUB 3000:POKE 823,CL:SB=3:GOSUB 5430
3250 IF CL<3 THEN AS="":GOTO 3300
3260 IF CL<7 THEN 3290
3270 AS="[F2]0117Moving & stationary targets presented"
3280 AS=AS+"[F2]0418at random from 50 to 300 meters":GOTO 3300
3290 AS="[F2]0617Slow, medium & fast targets[F2]1118from left & right"
3300 AS=AS+"[LGRN][F2]0723<Pull trigger to continue>[F3]00":GOSUB 3000
3310 IF PEEK(56321)=247 THEN RETURN
3320 IF PEEK(56321)<>127 THEN 3310
3330 GOSUB 3350:IF LS=0 THEN RETURN
3340 GOTO 3220
3350 POKE 53265,43:POKE 53272,31:POKE 198,0:AS="[F6]00[F5]00[F7]00[CLR][GRN]Level order:"
3360 AS=AS+"[GRY1][F2]3299ARI9112[GRN][F8]":FOR Z=1 TO 10:AS=AS+CHRS(30+(Z=LS)*2)
3370 BS="":IF LV%(Z)<>-1 THEN BS=STRS(LV%(Z))
3380 AS=AS+BS:NEXT Z
3390 REM AS=AS+"[F8][GRN]Wind speed: ":IF (WI AND 16) THEN AS=AS+" Variable"::GOTO3420
3400 REM AS=AS+STRS((WI AND 7)*5)+" MPH ":IF ((WI AND 7)=0) THEN 3420
3410 REM BS=STRS(INT(WI/32)+1):BS="0"+RIGHTS(BS,1):AS=AS+"[F4]"+BS
3420 AS=AS+"[BLK][F8][F8]":GOSUB 3000:POKE 253,1:POKE 254,10:POKE 823,0:SB=3:GOSUB 5430
3430 AS="[F8'[LBLU] D: View Moving Target Demo[F8] L: Change Level Order[F8]"
3440 AS=AS+" N: New firer[F8]":REM W: Set Wind Speed[F8]"
3450 AS=AS+CHRS(158+(CH=3)*4):AS=AS+" C: Set Crosshair status for Levels 7-10[LBLU]"
3460 AS=AS+"LP: Light Pen Mount Adjustment[F8][F8]"
3470 IF NU THEN AS=AS+"[GRN](Pretest diagnostic scores are numeric)[F8]"
3480 BS="number or letter":IF LS=0 THEN BS="letter"
3490 AS=AS+"[F2]0023[RED]Select "+BS+" & press RETURN[LBLU][F8][F3]00":GOSUB 3000
3500 AS="":GOSUB 5270:Z=INT(VAL(AS))
3510 I=1:IF (Z<1) OR (Z>10) OR (LS=0) THEN 3570
3520 IF LV%(I)<>Z THEN I=I+1:IF I<11 THEN 3520
3530 IF I<11 THEN LS=I:BL=0:RETURN
3540 POKE 53265,59:POKE 823,2:POKE 824,23:POKE 253,0:SYS CO
3550 AS="[F2]0010The level you choose must be in the[F8]current sequence.[F8][F8]"
3560 AS=AS+"Press RETURN to continue":GOSUB 5270:GOTO 3350
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3570 IF A$="D" THEN GOSUB 1420:RETURN
3580 IF A$="NU" THEN NU=NOT(NU):GOTO 3350
3590 IF A$="N" THEN LS=0:RETURN
3600 IF A$<>"L" THEN 3760
3610 I=1:A$="[F3]09[CLR][GRN]Choose level order:[F8][F8]Type a number (1-10) for the desired[F8]"
3620 A$=A$+"level, in the desired order of[F8]presentation.  Type 0 and press[F8]"
3630 A$=A$+"RETURN when done.[F8][F8][F3]00[LBLU]"
3640 FOR Z=1 TO 10:Z$=STR$(Z):IF Z<10 THEN Z$=" "+Z$
3650 A$=A$+Z$+": "+"[F8]":NEXT Z:GOSUB3000
3660 Z$=STR$(I+6):Z$=RIGHT$(Z$,LEN(Z$)-1):IF I<4 THEN Z$="0"+CHR$(I+54)
3670 A$="[BLUE][F2]04"+Z$:GOSUB 5270:IF (Z<0) OR (Z>10) THEN 3660
3680 A$="[LBLU][F2]04"+Z$+"      [F2]0599"+STR$(Z):GOSUB 3000
3690 IF Z>0 THEN 3720
3700 IF I=1 THEN 3350
3710 FOR Z=I TO 10:LV%(Z)=-1:NEXT Z:GOTO 3730
3720 LV%(I)=Z:I=I+1:IF I<11 THEN 3660
3730 A$="[GRN][F2]0018Is everything correct (type Y or N and[F8]press RETURN!"
3740 GOSUB 5270:IF A$<>"Y" THEN 3610
3750 LS=-(LS>0):GOTO 3350
3760 GOTO 3880:IF A$<>"W" THEN 3880
3770 A$="[F3]09[CLR]Wind Effects:[F8][F8]Type a number (1-3) for wind speed:[F8][F8]"
3780 A$=A$+" 1:  0 MPH[F8][F8] 2: 10 MPH[F8][F8] 3: 20 MPH[F8][F8][F3]00":GOSUB 3000
3790 A$="":GOSUB 5270:IF (Z<1) OR (Z>3) THEN 3790
3800 WI=(Z-1)*2:IF WI=6 THEN WI=16:GOTO 3350
3810 IF WI=0 THEN 3350
3820 A$="[F3]09[CLR]Wind Effects:[F8][F8]Type a number (1-8) for wind direction:[F8][F8]"
3830 A$=A$+" 1: [F4]01 (No value)[F8][F8] 2: [F4]02 (Half value)[F8][F8] 3: [F4]03 (Full value)[F8][F8]"
3840 A$=A$+" 4: [F4]04 (Half value)[F8][F8] 5: [F4]05 (No value)[F8][F8] 6: [F4]06 (Half value)[F8][F8]"
3850 A$=A$+" 7: [F4]07 (Full value)[F8][F8] 8: [F4]08 (Half value)[F8][F8][F3]00":GOSUB 3000
3860 A$="":GOSUB 5270:IF (Z<1) OR (Z>8) THEN 3860
3870 WI=WI+((Z-1)*32):GOTO 3350
3880 IF A$<>"C" THEN 3990
3890 A$="[F3]09[CLR]Set Crosshair status for Levels 7-10:[F8][F8]"
3900 A$=A$+CHR$(158+(CH<>0)*4)+" 1: Crosshair appears after each shot.[F8][LBLU]"
3910 A$=A$+CHR$(158+(CH<>1)*4)+" 2: Crosshair appears only when target[F8]"
3920 A$=A$+"    is missed.[F8][LBLU]"
3930 A$=A$+CHR$(158+(CH<>2)*4)+" 3: No Crosshair on Levels 7-10.[LBLU][F8]":GOSUB 3000
3940 A$=CHR$(158+(CH<>3)*4)+" 4: Level 7:  Crosshair after each shot."
3950 A$=A$+"       Level 8:  Crosshair for misses only."
3960 A$=A$+"       Levels 9 & 10: No crosshair.[F8][F8][LBLU][F3]00":GOSUB 3000
3970 A$="Type the number (1-4) of your choice":GOSUB 5270
3975 IF (Z<1) OR (Z>4) THEN 3970
3980 CH=Z-1:GOTO 3350
3990 Z=-(A$="LP"):IF Z>0 THEN 130
4000 GOTO 3500
4010 REM SETUP FOR REPLAY: CALL ONCE BEFORE ANY TARGETS PRESENTED
4020 POKE 2041,43:POKE 2042,43:POKE V+23,6:POKE V+29,6
4030 POKE V+40,1:POKE V+41,0:RETURN
4040 N=FNW(907):N=N+(N>128)*(N-128):Z=(N-30)*256+(N-1):IF N<30 THEN Z=N
4050 ME=0:IF TN>6 THEN POKE 785,FNL(TK):POKE 786,FNH(TK):ME=USR(Z)
4060 POKE 939,ME:IF PEEK(900)=255 THEN ME=-ME
4070 GOSUB 3020:HI=PEEK(900)<128
4080 J=0:GOSUB 3110:A$="[F3]05[CLR] [F5]00[F1]"+DS$(ME,0)+CR$:Z$=MID$(CR$,6,1)
4090 J=1:GOSUB 3110:A$=A$+DS$(ME,1):Z1$=CR$
4100 CR$="[F2]3099"+Z$+"check":IF CR%(0)>2 THEN CR$="[F2]3699"+Z$+"ok"
4110 B$=DS$(ME,2)+CR$
4120 J=2:GOSUB 3110:B$=B$+DS$(ME,3)+CR$:GOSUB 3200
4130 J=3:GOSUB 3110:TG=TG+2:IF HI=0 THEN CR$="[F2]3299[RED]miss":TG=TG-2
4140 IF (CR%(0)>3)AND(CR%(1)>3)AND(HI=0) THEN Z1$=CR$(3):CR%(1)=3
4150 CR$="[F3]160809[F1][F2]0008"+DS$(ME,4)+CR$:A$=A$+Z1$+B$
4160 IF ME<>2 THEN 4200
4170 Z=6+(TA>=36)*(6-ABS(TF)):IF TF<0 THEN Z=-Z
4180 Z=PEEK(903)*2+Z-23-TF:POKE V+4,ABS(FNL(Z))
4190 POKE V+16,((PEEK(V+16) AND 251) OR ((Z>255)*-4)):GOTO 4210
4200 PO=PO+D1%(TN,0)-23:PO=PO-(PO<0)*65536:POKE 839,FNL(PO):POKE 840,FNH(PO)
4210 POKE 841,Y+D1%(TN,1):POKE V+5,Y+D1%(TN,1)-25-TJ
4220 IF TN<7 THEN Z=8:GOTO 4250
4230 B$="tracked.":IF ME=2 THEN B$="trapped."
4240 A$=A$+"[F3]170809[WHT][F2]0908you "+B$:Z=10
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4250 GOSUB 3000:WS=128-(TN=1)*64-(TN=7)*64
4260 X=PEEK(V)+(PEEK(V+16) AND 1)*256-TF:POKE V,FNL(X)
4270 POKE V+16,((PEEK(V+16) AND 254) OR FNH(X))
4280 POKE 823,Z:POKE 824,25-Z:POKE 253,221:SYS CO:POKE 845,1:F=-1:SYS SV
4290 IF TN<7 THEN Z=TN*50:A$="":GOTO 4320
4300 Z=INT((2^(INT((TA AND 7)/2)+1))/.133)/10:A$="(F8)"+STR$(Z)
4310 A$=A$+" mph lateral speed":Z=-(TN=7)*60-(TN=8)*75-(TN=9)*125-(TN=10)*185
4320 A$="(BLK)(F2)0023"+STR$(Z)+" meters"+A$:GOSUB 3000
4330 POKE V+21,WS OR 6:A$="(BLK)(F2)2823(F1)(RVON)replay(RVOF)(F3)00":GOSUB 3000:N=FNW(905)
4340 N=N+(N>255)*(N-255):POKE 821,N:N=N-60:POKE 833,-N*(N>0):POKE 884,1
4350 IF (PEEK(884) AND 1)=0 THEN 4380
4360 IF (PEEK(56321)=247) AND (F=0) THEN POKE 884,0:Z=0:GOTO 4490
4370 GOTO 4350
4380 POKE 823,8:POKE 824,2:POKE 253,0:SYS CO:A$=CR$:GOSUB 3000
4390 F=1:Z=1
4400 IF PEEK(56321)=247 THEN Z=0:GOTO 4490
4410 IF PEEK(56321)=127 THEN Z=128:GOTO 4490
4420 Z=Z+1:IF Z<50 THEN 4400
4430 F=F+1:IF F<>2 THEN 4460
4440 A$="(BLK)(F2)2823pull trigger(F2)2824to continue "
4450 GOSUB 3000:POKE V+21,WS OR 1:Z=0:GOTO 4400
4460 F=0:IF TN<7 THEN POKE 823,8:POKE 824,2:POKE 253,221:SYS CO:GOTO 4330
4470 B$="tracked.":IF ME=2 THEN B$="trapped."
4480 A$="(F1)(F3)160809(WHT)(F2)0908you "+B$:GOSUB 3000:GOTO 4330
4490 GOSUB 3200:POKE V+21,0:RETURN
4500 A$="(F3)09(F6)00(CLR)(F5)13(F7)00(BLK)":GOSUB 3000:Z1=TA:Z2=0:Z3=0
4510 POKE 785,FNL(GP):POKE 786,FNH(GP):POKE 940,160:POKE 942,100
4520 FOR Z5=1 TO Z4:POKE 251,FNL(Z):POKE 252,FNH(Z):POKE 880,Z1:POKE 881,N
4530 Z=USR(0):Z1=Z1+2:Z2=Z2+PEEK(824):Z3=Z3+PEEK(823):NEXT Z5:IFZ2=0THEN RETURN
4540 A$="(F2)1302Your"+STR$(Z2)+" shot(s)"
4550 IF Z3>0 THEN A$=A$+"(F2)1003"+STR$(Z3)+" shot(s) missing"
4560 Z2=-(TN=7)*60-(TN=8)*75-(TN=9)*125-(TN=10)*185
4570 A$=A$+"(F2)1404"+STR$(Z2)+" meters":B$="":IF (Z4<>1) OR (TA<7) THEN 4575
4571 Z=INT((2^(INT((TA AND 7)/2)+1))/.133)/10:B$=STR$(Z)+" mph"
4572 IF Z=1.5 THEN B$="(C/LF)"+B$
4574 A$=A$+"(F2)1605"+B$:B$="(F2)1205(F4)07":IF (TA AND 1)=0 THEN B$="(F2)2605(F4)03"
4575 A$=A$+B$:GOSUB 3170:POKE 53265,43:RETURN
4580 AD=FNW(876):TN=PEEK(AD+3):TA=TN:IF TN>6 THEN TN=INT(TN/8)+6
4590 X=PEEK(AD+1):Y=PEEK(AD+2):MV=(PEEK(AD+8)>0):IF MV THEN 4610
4600 X=((INT(RND(1)*65))*2)+71:POKE AD+1,X:IF TN=1 THEN POKE AD+16,X+48
4610 TJ=PEEK(AD+11):TJ=TJ+(TJ>127)*256:Z1=D2%(TN,2):S=((TN-1)*2)+Z1
4620 PO=0:TF=PEEK(AD+9)*2:IF MV THEN S=PEEK(AD+3)+6-INT(PEEK(AD+3)/8)*2:PO=6
4630 IF TA>=36 THEN PO=TF:REM 185M 6MPH
4640 IF PEEK(AD+8)>128 THEN TF=-TF:PO=-PO
4650 POKE 838,S:POKE 889,0:POKE 890,160:POKE 891,40:POKE 892,180
4660 AD=I1+S*8:POKE AD+7,I:POKE 900,255:POKE AD,255:GOSUB 4020
4670 A$="L="+STR$(CL)+"]T="+STR$(I)+"]R="+STR$(RP):GOSUB 5230:POKE I2+7+S*8,RP
4680 Z=IR:SB=0:GOSUB 5440:POKE 878,0
4690 IF Z<>128 THEN D2%(TN,2)=D2%(TN,2)+1
4700 Z=Z+((PEEK(900)=255) AND (Z<>128))*(Z-64):IF Z>63 THEN RETURN
4710 Z1=(PEEK(900)<128):Z2=NOT(Z1):D2%(TN,0)=D2%(TN,0)-Z1
4720 D2%(TN,1)=D2%(TN,1)-Z2:IF Z2 THEN GOSUB 4040:IF Z<>128 THEN Z=32
4730 RETURN
4740 FOR J=0 TO 3:SD(J,36)=SD(J,36)/3:NEXT J
4750 A=S:B=Z:S=36:J=0:GOSUB 3110:A$="(F3)05(F6)00(F5)00(F7)00(CLR)(F1)"+DS$(0,0)+CR$
4760 Z$=MID$(CR$,6,1):J=1:GOSUB 3110:A$=A$+DS$(0,1)+"(F2)3499---"
4770 CR$="(F2)3099"+Z$+"check":IF CR%(0)>2 THEN CR$="(F2)3699"+Z$+"ok"
4780 A$=A$+DS$(0,2)+CR$
4790 J=2:GOSUB 3110:A$=A$+DS$(0,3)+CR$:J=3:GOSUB 3110
4800 S=A:Z=B:GOSUB 3000:POKE 785,FNL(GP):POKE 786,FNH(GP):POKE 251,FNL(Z)
4810 POKE 252,FNH(Z):POKE 880,5:POKE 881,3:Z=USR(0):A$=""
4820 IF PEEK(823)>0 THEN A$=A$+"(BLK)(F2)0921"+STR$(PEEK(823))+" shot(s) off screen"
4830 POKE 823,8:POKE 824,15:POKE 253,13:SYS CO:A$=A$+"(SWLC)(LGRN)":GOSUB 3170
4840 POKE 53265,43:RETURN
4845 FOR I=0 TO 4:D2%(I,0)=D2%(I,0)+D2%(I,2):D2%(I,1)=D2%(I,1)+D2%(I,3):NEXT I
4846 RETURN
4850 IF PEEK(838)=0 THEN RETURN
4860 Z=-(CL=3)*60-(CL=4)*75-(CL=5)*125-(CL=6)*185
4870 A$="(F3)09(CLR)(F6)00(F5)00(F7)00(LBLU)(F2)0801Summary:"+STR$(Z)+"-meter targets(F8)(F8)"
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4880 A$=A$+"[GRN][F2|0599Number of targets tracked --"+STR$(D2%(4.0))+"[F8][F8]":GOSUB 3000
4890 A$="":ME=1:Z=0:GOSUB 4940:Z$=MID$(CR$.6.1):Z=1:GOSUB 4940:GOSUB 4970
4900 Z=3:GOSUB 4940:Z=4:GOSUB 4940:GOSUB 3000
4910 A$="[F8][F8][F8][GRN][SWLC][F2|0599Number of targets trapped --"+STR$(D2%(4.1))+":F8][F8]":GOSUB 3000
4920 A$="":ME=2:Z=0:GOSUB 4940:Z$=MID$(CR$.6.1):Z=1:GOSUB 4940:GOSUB 4970
4930 Z=3:GOSUB 4940:Z=4:GOSUB 4940:A$=A$+"[LGRN][SWLC]":GOSUB 3170:RETURN
4940 A$=A$+CHR$(142)+"[F2|0899"+D$$(ME,Z):Z1=D2%(4,ME-1):Z=Z+(Z>2)
4945 IF Z1=0 THEN A$=A$+"[F2|2999[WHT]---[F8]":RETURN
4950 Z1=INT(D2%(Z,ME-1)/Z1+.5):CR$=CR$(Z1):B$=RIGHT$(STR$(38-LEN(CR$)).2)
4960 A$=A$+"[F2]"+B$+"99"+RIGHT$(CR$.LEN(CR$)-5)+"[F8]":D2%(Z,ME-1)=Z1:RETURN
4970 A$=A$+"[F2|0899"+D$$(ME,2):IF D2%(4,ME-1)=0 THEN A$=A$+"[F2|2999[WHT]---[F8]":RETURN
4980 CR$="[F2|2799"+Z$+"check":IF D2%(0,ME-1)>2 THEN CR$="[F2|3099"+Z$+"ok"
4990 A$=A$+CR$+"[F8]":RETURN
5000 A$=A$+"[F2|0203[LBLU]Range [BRN]Exposures [GRN]Hits [RED]Misses[YELO] No Fires[F8]"
5010 A$=A$+"[LBLU][F2|1499(Stationary)[F8]":GOSUB 3000:HI=0
5020 FOR I=0 TO 5:H%(I)=0:NEXT I:SYS HM:FOR I=1 TO 10:Z=I:Z1=I*50
5030 IF I>6 THEN Z=(I-6)*8:Z1=-(I=7)*60-(I=8)*75-(I=9)*125-(I=10)*185
5040 Z2=PEEK(16192+Z):Z3=PEEK(16256+Z):Z4=PEEK(16320+Z):A$="[LBLU][F2|0299"+STR$(Z1)
5050 A$=A$+"[F2|1199[BRN]"+STR$(D1%(I,CL-5)):H%(HI)=H%(HI)+Z2:H%(HI+2)=H%(HI+2)+Z3
5060 Z4=D1%(I,CL-5)-Z4:Z4=Z4+(Z4<0)*Z4:H%(HI+4)=H%(HI+4)+Z4
5070 A$=A$+"[GRN][F2|1899"+STR$(Z2)+"[RED][F2|2499"+STR$(Z3)+"[YELO][F2|3299"+STR$(Z4)+":[F8]"
5080 GOSUB 3000:IF I<6 THEN 5110
5090 Z1=-12*(CL=7)-10*(CL=8)-14*(CL=9)-10*(CL=10):H%(7)=Z1
5100 HI=H%(0):MI=H%(2):NF=H%(4):GOSUB 5410:HI=1:A$="[SWLC][LBLU][F2|1699(Moving)[F8]":GOSUB3000
5110 NEXT I:Z1=-24*(CL=7)-20*(CL=8)-26*(CL=9)-20*(CL=10):H%(8)=Z1
5120 HI=H%(1):MI=H%(3):NF=H%(5):GOSUB 5410
5130 Z1=-36*(CL=7)-30*(CL=8)-40*(CL=9)-30*(CL=10)
5140 HI=H%(0)+H%(1):MI=H%(2)+H%(3):NF=H%(4)+H%(5)
5150 A$="[SWLC][F2|1499[RED]UNQUALIFIED":Z1=-8*(CL=7)-7*(CL=8)-10*(CL=9)-7*(CL=10)
5160 Z2=-16*(CL=7)-15*(CL=8)-20*(CL=9)-15*(CL=10)
5170 IF (H%(0)>=Z1) AND (H%(1)>=Z2) THEN A$="[SWLC][F2|1599[GRN]QUALIFIED":A=A+1
5180 A$=A$+"[F8][F8][LBLU]Stationary Target Standard:Hit"+STR$(Z1)+" of"+STR$(H%(7))+"[F8]"
5190 A$=A$+"Moving Target Standard:Hit"+STR$(Z2)+" of"+STR$(H%(8))+"[LGRN]"
5200 GOSUB 3170:RETURN
5210 A$="[F3|09[F6|00[F5|00[F7|00[CLR][RED][SWLC][F1][F2|0407You did not meet[F2|0710the standard."
5220 A$=A$+"[F2|0213Prepare to refire.[F1]":GOSUB 3160:BC=2:RETURN
5230 B$="":IF ((WI AND 7)*5)=0 THEN5260
5240 B$=STR$(((WI AND 224)/32)+1)
5250 B$="[F2|3400W="+STR$((WI AND 7)*5)+"[F4|0"+RIGHT$(B$,1)
5260 A$="[HOME][BLK][RVON][SWLC]"+A$+B$+"[F6|0"+CHR$(BC+48)+"[BLUE]":GOSUB 3000:RETURN
5270 A$=A$+"? /   [C/LF][C/LF][C/LF][C/LF]":GOSUB3000:B$=""
5280 GET A$:IF A$="" THEN 5280
5290 IF (A$=CHR$(13)) OR (LEN(B$)>2) THEN PRINT"[C/UP]":A$=B$:Z=INT(VAL(A$)):RETURN
5300 IF A$<>CHR$(20) THEN 5330
5310 IF B$<>"" THEN B$=LEFT$(B$,LEN(B$)-1):A$=" [C/LF][C/LF] [C/LF]/[C/LF]":GOSUB 3000
5320 GOTO 5280
5330 A$=CHR$(ASC(A$) AND 127):IF (A$<"0") OR (A$>"z") THEN 5280
5340 IF (A$>="a") AND (A$<="z") THEN A$=CHR$(ASC(A$) OR 128)
5350 B$=B$+A$:A$=A$+"/[C/LF]":GOSUB 3000:GOTO 5280
5360 FOR Z=I1 TO I1+343 STEP 8:POKE Z,255:NEXT Z:RETURN
5370 FOR Z=I2 TO I2+343 STEP 8:POKE Z,255:NEXT Z:RETURN
5380 A$="[F3|09[F6|00[CLR][F5|00[F7|00":GOSUB 3000
5390 POKE 823,12:POKE 824,12:POKE 253,221:SYS CO
5400 A$=B$+"[HOME][LBLU]":GOSUB 3000:Z=USR(Z1+Z2*256):RETURN
5410 A$="[SWLC][F2|0299[GRY2]TOTAL[F2|1199[BRN]"+STR$(Z1)+"[F2|1899[GRN]"+STR$(HI)+"[F2|2499[RED]"+STR$(MI)
5420 A$=A$+"[F2|3299[YELO]"+STR$(NF)+"[F8]":GOSUB 3000:RETURN
5430 POKE 49163,1:POKE 49168,SB:POKE 49171,32:SYS 49162:RETURN
5440 POKE 785,10:POKE 786,192:POKE 49163,1:POKE 49168,SB:POKE 49171,32
5450 Z=USR(Z):RETURN
5460 POKE 49163,2:POKE 49168,SB:POKE 49171,32:SYS 49162:RETURN
5470 POKE 785,10:POKE 786,192:POKE 49163,2:POKE 49168,SB:POKE 49171,32
5480 Z=USR(Z):RETURN
6000 DATA 47,32,2,1,1,1,2, 23,36,2,3,2,3,3, 11,12,2,1,2,2,2
6010 DATA 11,14,2,1,2,2,3, 11,15,2,2,1,1,1, 11,16,2,2,2,1,3
6020 DATA 23,19,6,4,3,3,8, 23,24,6,7,7,6,10, 23,32,6,5,5,8,5, 11,13,6,4,5,3,3
6030 DATA "[WHT]steady pos","[WHT]aiming","[WHT]breath con","[WHT]trigger sq","[LBLU]shot loc"
6040 DATA "[WHT]smth track","[WHT]lead","[WHT]breath con","[WHT]trigger sq","[LBLU]shot loc"
6050 DATA "[WHT]steady pos","[WHT]lead","[WHT]breath con","[WHT]trig pull","[LBLU]shot loc"
6060 DATA "[F2|3299[RED]poor","[F2|2299[ORNG]below avg","[F2|2699[YELO]average","[F2|3299[LGRN]good"
```

6070 DATA "|F2|2299|GRN|excellent"

E-PROM Addresses

ITEM	COPY ADDRESS		CHIP ADDRESS		SIZE	
Chip 0, Bank 0						
STARTUP	49152	50704	32768	34320	1,553	
OPENING.SCENARIO	8192	40949	35154	39514	4,361	
LETTERS	57344	58788	39515	40949	1,435	
Total						7,349
Chip 0, Bank 1						
MLCHOBK1	32768	39229	32768	39229	6,462	
CALIBRATION	16384	17212	40131	40959	829	
Total						7.291
Chip 0, Bank 2						
MLCHOBK2	32768	38782	32768	38782	6,015	
ARM.SPRITES	2176	3199	39936	40959	1,024	
Total						7,039
Chip 0, Bank 3						
ARM.SCENARIO.1	8192	16191	32768	37444	4,677	
ARM.SCENARIO.2	8192	16191	37445	40483	3,039	
Total						7.716
Chip 1, Bank 0						
ARM.BAS (1)	16384	24575	32768	40959	8,192	
Total						8,192
Chip 1, Bank 1						
ARM.BAS (2)	24576	32767	32768	40959	8,192	
Total						8,192
Chip 1, Bank 2						
ARM.BAS (3)	32768	37184	32768	37184	4,417	
Total						4,417
Chip 1, Bank 3						
ARM.3200	3200	7995	32768	37563	4,796	
ARM.SCENARIO.3	8192	16191	38042	40959	2,918	
Total						7,714
Total Size						57,910

Lines 1-310: Main program.
    Lines 1-80: Program and variable initialization.
    Lines 90-130: Checks for certain keypresses and/or trigger pull.
        Line 90: Runs menu if RUN/STOP key is pressed.
        Line 100: Begins the program is the trigger is pulled.
        Line 110-130: Runs the lightpen calibration program if "lp" is pressed.
    Lines 140-210: Displays a text screen and initializes the arrays.
    Lines 212-214: Asks the firer if telescope or iron sights will be used and sets up the appropriate sprite.
    Lines 220-240: Displays a text screen.
    Line 250: Calls the zero routine.
    Line 260: Calls the routine that displays the level introduction screen.
    Line 270: Calls the appropriate level based on the value of CL.
    Line 280: Checks to see if the program is ready to be terminated.
    Lines 290-310: Displays the congratulations screen.

Lines 1000-1410: Zeroing routine.
    Lines 1000-1170: Introduction screens and initialization.
    Lines 1180-1190: If the @ key was pressed at line 1060, the target will always appear in the center of the screen rather than at random locations.
    Line 1200: Display the target and check for the RUN/STOP key.
    Line 1210: Get the diagnostic scores for the shot.
    Lines 1220-1250: Compute the lightpen offset and see if the readings are within acceptable bounds around the target.
    Line 1260: Make sure the trigger has been released and go to line 1410 if only one or two shots have been fired.
    Lines 1270-1320: If any shot was out of the acceptable bounds, the invalid shot group screen is displayed. If this is the second time, the additional message to see the manual is shown.
    Lines 1330-1350: Computes the lightpen offset based on the center of the three-round shot group.
    Lines 1360-1370: Displays the three-round shot group and waits for the trigger to be pulled.
    Lines 1380-1410: Unless the shot group was excellent, the firer is asked if he wants to try for a better group.

Lines 1420-1430: Calls the machine language demonstration routine.

Lines 1440-2060: Levels 1-2.
    Lines 1440-1550: Introductory screens.
    Lines 1560-1620: Get the appropriate targets.
    Line 1630: Put up the background the status line.
    Lines 1640-1670: Determine the proper sight post offset, time of flight, and trajectory.
    Line 1680: Display the target and check for the RUN/STOP key.
    Line 1690: Blow the whistle if time expired.
    Lines 1700-1710: Display hit or miss.
    Line 1720: Call the replay routine.
    Lines 1730-1740: Adds a hit to the proper counter (track or trap).
    Lines 1750-1810: If the correct method of engagement was not employed, notify the firer.
    Line 1820: Add 1 to the shot counter and repeat if not time to show a

group.
Line 1830: Display the shot group.
Lines 1840-1910: Show the firer's performance and the standards.
Lines 1920-1950: Display the "You did not meet the standard" screen.
Lines 1960-2000: Hint for smooth tracking.
Lines 2010-2030: Hint for proper trapping.
Line 2040: Reset the counters and refire.
Line 2050: Prepare to shoot the second set of five targets.
Line 2060: Advance to the next level unless the break key was pressed.

Lines 2070-2440: Levels 3-6.
    Lines 2070-2130: Introductory screens.
    Lines 2140-2170: Get the appropriate targets.
    Lines 2180-2220: Initialization.
    Lines 2230-2240: Put up the background the status line.
    Lines 2250-2280: Determine the proper sight post offset, time of flight,
    and trajectory and set up for replay.
    Lines 2290-2295: Display the target and check for the RUN/STOP key.
    Line 2300: Sound the whistle if time expired.
    Lines 2310-2320: Display hit or miss.
    Line 2330: Handle the case of a no fire.
    Line 2340: Update the hit counter.
    Lines 2350-2360: Call the replay routine and update the counters for the
    diagnostic scores.
    Line 2370: Add 1 to the shot counter and repeat if not time to show a
    group.
    Line 2380: Display the shot group.
    Lines 2390-2410: Restore the counters and display the "You did not meet the
    standard" screen.
    Line 2420: Prepare for the next group of shots.
    Line 2440: Display the summary and advance to the next level unless the
    break key was pressed.

Lines 2450-2620: Level 7.
    Lines 2450-2470: Introductory screens.
    Lines 2480-2530: Initialization.
    Line 2540: Check number of shots and branch to end if done.
    Line 2550: Display the background scene if necessary.
    Line 2560: Call the subroutine at 4580 and branch if break key was pressed.
    Lines 2570-2580: Sound the whistle if time expired, otherwise repeat loop.
    Lines 2590-2600: Display the summary screen.
    Line 2610: Check for failure to meet the standards and branch if necessary.
    Line 2620: Update the current level pointer and return.

Lines 2630-2830: Levels 8-10.
    Lines 2630-2680: Introductory screens.
    Lines 2690-2770: Initialization.
    Lines 2780-2790: Display the background scene and call the assembly
    language subroutine to handle the target scenario.
    Lines 2800-2810: Display the summary screen.
    Line 2820: Check for failure to meet the standards and branch if necessary.
    Line 2830: Update the current level pointer and return.

Lines 3000-5480: Supporting Subroutines.
   Line 3000: Display the string in A$ on the graphic screen.
   Line 3010: Display a background scene where S1 contains the EPROM address
   and S2 contains the chip number.
   Lines 3020-3060: Set up and call the assembly language routine which
   calculates the scores. Initially, the values in the SD array are the
   starting (high byte) and stopping (low byte) addresses for the light pen
   readings buffers. On return, they contain the scores.
   Lines 3070-3080: Save certain key variables in the H% array.
   Lines 3090-3100: Restore certain key variables that were stored in the H%
   array.
   Lines 3110-3150: Determine the appropriate word scores for the values in
   the SD array.
   Lines 3160-3210: Display appropriate "Pull trigger..." message and wait for
   trigger pull or stop key.
   Lines 3220-3340: Display the level introduction screen and call the menu
   subroutine if the break key is pressed.
   Lines 3350-4000: Display the menu and accept appropriate input.
   Lines 4010-4030: Initialization for the replay.
   Lines 4040-4490: Calculate and display the diagnostic scores and replay the
   shot.
      Lines 4040-4070: Call the routines which compute the scores and
      determine the method of engagement (tracking or trapping) for moving
      targets.
      Lines 4080-4150: Get the verbal scores based on the numeric scores.
      Lines 4160-4210: Determine the proper time of flight, perfect sight
      offset, and trajectory.
      Lines 4220-4240: Add the words "You trapped" or "You trapped" to the
      string to be displayed.
      Lines 4250-4340: Initialize sprites where the positions are known, set
      the target area of the screen to green, display other information, and
      start the replay.
      Lines 4350-4490: Timing loops for displaying proper wording and showing
      the replay again if necessary.
   Lines 4500-4575: Show a shot group for a target at a particular range.
   Lines 4580-4730: Level 7 target scenario.
   Lines 4740-4840: Display the diagnostic scores and shot group for the
   zeroing procedure.
   Lines 4845-4846: Add the diagnostic scores and number of engagements for
   the current group to the diagnostic scores and number of engagements for
   previous groups.
   Lines 4850-4930: Summary screen for levels 3-6.
   Lines 4940-4990: Subroutines to check special cases of scoring.
   Lines 5000-5200: Summary screen for levels 7-10.
   Lines 5210-5220: Display "You did not meet the standard...".
   Lines 5230-5260: Display the status line at the upper left corner of the
   firing scenario.
   Lines 5270-5350: Get input for the menu.
   Line 5360: Initialize the INFO1 buffer to no fires.
   Line 5370: Initialize the INFO2 buffer to no fires.
   Lines 5380-5400: Clear graphic screen and set the center portion to green.

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Lines 5410-5420: Used by the subroutine at 5000 to print the total line.
Line 5430: Call the assembly language subroutine in bank 1 of EPROM chip 0 referenced by the address in SB.
Lines 5440-5450: Call the assembly language subroutine in bank 1 of EPROM chip 0 referenced by the address in SB with a parameter in Z.
Line 5460: Call the assembly language subroutine in bank 2 of EPROM chip 0 referenced by the address in SB.
Lines 5470-5480: Call the assembly language subroutine in bank 2 of EPROM chip 0 referenced by the address in SB with a parameter in Z.
Lines 6000-6070: Data
    Lines 6000-6020: Target specific data read into the D1% array.
    Lines 6030-6050: The names of the diagnostic scores read into the DS$ array.
    Lines 6060-6070: The verbal scores read into the CR$ array.

APPENDIX D

DOCUMENTATION -- INFANTRY RIFLE MARKSMANSHIP COMMODORE PROGRAM

MACS Infantry Rifle Marksmanship
Line description of BASIC module
27 December 1991

Lines 1-310: Main program.
    Lines 1-80: Program and variable initialization.
    Lines 90-130: Keyboard/trigger-pull check.
        Line 90: Display menu if RUN/STOP key is pressed.
        Line 100: Begin program if trigger is pulled.
        Line 110-130: Run the lightpen calibration if "lp" is pressed.
    Lines 140-210: Display text screen and initialize program arrays.
    Lines 220-240: Display a text screen.
    Line 250: Call the lightpen zeroing routine.
    Line 260: Call the level introduction screen.
    Line 270: Call the appropriate level based on CL variable.
    Line 280: Check to see if program ready to be terminated.
    Lines 290-310: Display the congratulations screen.

Lines 1000-1410: Lightpen zeroing routine.
    Lines 1000-1170: Introduction screens and initialization.
    Lines 1180-1190: If the '@' key was pressed, the zeroing target will
    always be displayed in the center of the screen.
    Line 1200: Display target and check for RUN/STOP key.
    Line 1210: Get the diagnostic scores for the shot.
    Lines 1220-1250: Compute the lightpen offset and verify reading are
            within acceptable bounds of target.
    Line 1260: Verify trigger release and goto 1410 if all three shots
            have not been fired.
    Lines 1270-1320: If an shot location is outside of the acceptable
            bounds, display the invalid shot group screen. If this is
            the second occurance, the firer is asked to refer to the
            MACS manual.
    Lines 1330-1350: Compute the lightpen offset based on the center
            of the three-round shot group.
    Lines 1360-1370: Display the adjusted three-round shot group and wait
            for the trigger to be pulled.
    Lines 1380-1410: Unless the shot group was excellent, the firer is
            asked if he/she wants to try for a better shot group.

Lines 1440-2070: All levels.
    Lines 1420-1447: Calls introductory screens for all levels.
        Line 1440: Initializes all level variables.
        Lines 1442-1443: Call level 2 introductory screens.
        Line 1445: Call level 1 introductory screens.
        Line 1446: Call level 3 introductory screens.
        Line 1447: Call level 4 intruductory screens.
    Lines 1450-1490: Load appropriate targets for current level.
    Lines 1500-1610: Initialize variables for target presentation.
    Line 1611: Call the routine to display shooting requirements for the
            current level.
    Lines 1615-1627: If applicable, calculate wind variables.
    Line 1630: Display the background scenario and status line.
    Line 1640-1670: Calculate the proper sight-post offset, time of
            flight, and bullet trajectory for current level.
    Line 1680: Display the target and check keyboard for RUN/STOP key.
    Line 1690: Blow the whistle if time has expired.
    Lines 1700-1710: Display HIT or MISS on screen.

Line 1720: Call the replay routine.
Lines 1810-1815: If time had expired, reload the previous target.
Line 1820: Add 1 to the shot counter and repeat if not time to show shot group for current target.
Lines 1824-1826: Display the shot group if appropriate for current target set.
Lines 1840-1910: Display the firer's performance and expected standards for current level.
Lines 1920-1950: Display the standard not met screen and wait for trigger pull to continue.
Lines 1955-2060: Adjust appropriate variables for current level and repeat necessary logic to complete the current level.
Line 2070: Advance the firer to the next level unless the BREAK key was pressed.

Lines 3000-5480: Supporting routines.
Line 3000: Display the text string stored in a$ variable on the graphic screen.
Line 3010: Display a background scenario where S1 contains the EPROM address of the scene and S2 contains the appropriate chip-reference number. The chip-reference number specifies the physical chip and bank number which contains the scene to be displayed. The formula is: (chip#) * 4 + bank number.
Lines 3020-3060: Setup and call the assembly language routine which calculates the scores for the last target. Initially, the SD array contains the starting (high byte) and stopping (low byte) addresses for the light-pen readings. On return, the SD array is filled with the scores calculated.
Lines 3070-3080: Save certain key variables related to the current shot in the h% array. These are needed when a target needs to be repeated.
Lines 3090-3100: Restore the variables previously stored in the h% array.
Lines 3110-3150: Translate the scores stored in the SD array to text string.
Lines 3160-3210: Display pull trigger message and wait for trigger pull to continue.
Lines 3220-3340: Display the appropriate level introductory screen and call the menu routine if the BREAK key is pressed.
Lines 3350-4000: Display the menu and accept user input.
Lines 4010-4030: Initialize variables for the replay.
Lines 4040-4490: Calculate the display and diagnostic scores and replay the last shot.
Lines 4040-4070: Call routines to compute scores and, if appropriate, determine whether the shot was a TRAP or a TRACK.
Lines 4080-4150: Translate numeric scores to verbal scores.
Lines 4160-4210: Determine the proper time of flight, perfect sight offset, and bullet trajectory.
Lines 4220-4240: If appropriate, add the words TRAP or TRACK to the string to be displayed.
Lines 4250-4340: Initialize necessary sprites and begin the target replay.
Lines 4350-4490: Control and timing loops for the replay logic.
Lines 4500-4575: Display a shot group for a target at the current range.
Lines 4740-4840: Display the diagnostic scores and shot group for

the zeroing routine.

Lines 4845-4846: Add the current diagnostic scores and engagement count to previous diagnostic scores and engagement count.

Lines 4850-4930: Display the TRACK vs. TRAP summary screen. This routine is currently unused.

Lines 4940-4990: Special subroutines required for some cases of scoring.

Lines 5210-5220: Display standard not met screen.

Lines 5230-5260: Display the status line in the upper left corner of the current scene and, if appropriate, the wind in the upper right hand corner.

Lines 5270-5350: Retrieve input for the menu.

Line 5360: Initialize the INFO1 buffer to no fires.

Line 5370: Initialize the INFO2 buffer to no fires.

Lines 5380-5400: Clear the graphic screen.

Line 5430: Call the assembly language routine in BANK 1 of EPROM chip 0. The SB variable identifies the routine to call.

Lines 5440-5450: Call the assembly language routine in BANK 1 of EPROM chip 0. The SB variable identifies the routine to call and the Z variable is passed as a parameter.

Line 5460: Call the assembly language routine in BANK 2 of EPROM chip 0. The SB variable identifies the routine to call.

Lines 5470-5480: Call the assembly language in BANK 2 of EPROM chip 0. The SB variable identifies the routine to call and the Z variable is passed as a parameter.

Lines 6000-6070: Data.
  Lines 6000-6020: Target specific data read into the d1% array.
  Lines 6030-6050: The names of the diagnostic scores to be read into the ds% array.
  Lines 6060-6070: The verbal scores to be read into the cr% array.

Lines 8000-9570: Supporting screens.
  Lines 8000-8080: Load reticle sprite data.
  Lines 8100-8270: Introductory screens for level 3.
  Lines 8300-8365: Load 400, 500, and 600 meter sprite data.
  Lines 8370-8430: Load 60, 75, and 125 meter sprites required by the demonstration routine.
  Lines 8450-8459: Overlay 300 meter sprite data with appropriate 300+ sprite data for proper shot group display.
  Lines 8460-8463: Restore 300 meter sprite data.
  Lines 8500-8710: Introductory screens for level 1.
  Lines 8800-8885: Introductory screens for level 2.
  Lines 9000-9350: Required standards screen for all levels.
  Lines 9500-9530: Introductory screens for level 4.
  Lines 9540-9570: Wind notice screen for level 4 displayed prior to the incorporation of wind.

15 November 1991

BASIC BURNING PROCEDURE:

```
+------------------------------------------------------+
¦ If the BASIC program changes size, the end-of-BASIC ¦
¦ value must be updated in the STARTUP.TXT program.    ¦
+------------------------------------------------------+
poke 56, 31
load "PROMO*", 8
run
poke 44, 64
poke 16384, 0
load "ARM.Z", 8
π 16384, 24575, 0     , 230, 6
π 24576, 32767, 8192  , 230, 6
π 32768, 40959, 16384, 230, 6


;
;          Reserve BASIC-safe memory for PROMOS before loading.
;
           poke 56,31
           load "PROMO*",8
           run
;
;          Reset pointer to start of BASIC text.  The start of BASIC
;          text must match the parameters for BASIC as defined in the
;          STARTUP.TXT program (16384).  This MUST be done because the
;          program will be tokenized when loaded and all references
;          will be "hard-coded".
;
           poke 44, 64
           poke 16384, 0
;
;          Now load the BASIC program.
;
           load "ARM.AL",8
;
;          PROMOS burn commands follow. (assuming 12.5 volt chips)
;
           π 16384, 24575, 0     , 230, 6
           π 24576, 32767, 8192  , 230, 6
           π 32768, 40959, 16384, 230, 6
```

CHIP BANK MEMORY LOCATIONS:

```
(0)     0       start of BANK 0
(1)     8192    start of BANK 1
(2)     16384   start of BANK 2
(3)     24576   start of BANK 3
```

BASIC ROUTINES:

gosub 3000   Display a$ on graphics screen (LETTERS). If function keys

are included in the string to be displayed, they will be interpreted in the following manner:

```
<F1>  toggle size (1x or 2x)
<F2>  (+4 bytes) set cursor position (column row)
<F3>  (+2 bytes) encoded bits
        bit 0  (1)   set=blank screen   clr=unblank screen
        bit 1  (2)   set=text mode      clr=graphics mode
        bit 2  (4)   set=upper case     clr=no change
        bit 3  (8)   set=lower case     clr=no change
<F5>  (+2 bytes) screen color
<F6>  (+2 bytes) border color
<F7>  (+2 bytes) character color
<F8>  insert carriage return
* Also accepts color, cursor keys, and clear keys.
```

gosub 5430   Call a specific assembly language routine via MLCH0BK1. The SB variable denotes the desired routine:

SB	ASSEMBLY LANGUAGE ROUTINE
0	ctrmov
3	descrp
6	random
9	dodata
12	rekeep
15	yesno
18	getxy
21	rndize
24	exptar
27	criter
30	yesno2

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